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OPERATING PROCEDURES FOR ANTHROPOMETRY AND INITIAL CONDITIONS PHOTOGRAMMETRIC PROGRAM

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Software Documentation

March 1994

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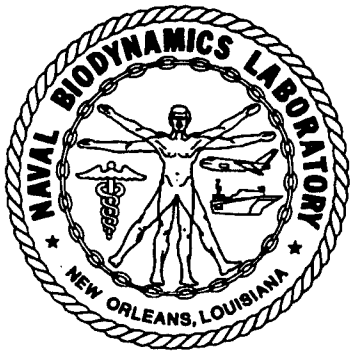

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This publication provides documentation of the Anthropometry and Initial Conditions Photogrammetric Program used on an IBM-compatible 486 personal computer at the Naval Biodynamics Laboratory in New Orleans, LA.

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OPERATING PROCEDURES FOR ANTHROPOMETRY AND INITIAL CONDITIONS PHOTOGRAMMETRIC PROGRAM

Introduction

The Naval Biodynamics Laboratory (NAVBIODYNLAB), located in New Orleans, Louisiana, is a research facility under the cognizance of the Naval Medical Research and Development Command. It is the principal Navy laboratory conducting biomedical research on the effects of mechanical forces encountered in Navy aircrafts and ships. Among its goals are the establishment of human tolerance limits and the development of appropriate methods of avoiding and treating the deleterious effects of such forces. Ongoing research programs at the laboratory acquire sensor and photographic impact acceleration data from acceleration sled runs.

To analyze this data, certain anthropometric information about each subject is necessary. Two anatomical coordinate systems are used, one on the head and one at the base of the neck on the first thoracic vertebra (T-1); these systems are depicted in Figures 1 and 2. The methodology for defining them and for obtaining the appropriate data has been reported previously (Becker, 1977). Motion data collected from inertial instrumentation packages on the head and T-1 are referenced to their own coordinate system; thus knowledge of the transformation matrices from the instrument to the anatomical coordinate systems is also required.

Neck and body information is obtained from two sets of stereoscopic X-rays of the subject with instrument mounts in place. X-rays are taken of T-1, and a set of calibration X-rays is made utilizing a Plexiglass™ target containing an array of radio-opaque BBs located at known positions. A special chair with additional BBs is used to ensure that the subject does not move while a stereoscopic pair of X-rays is made. This "stereopair" consists of two X-rays of the same area taken from different positions so as to afford stereoscopic vision. Two sets of stereopairs (a total of four X-rays) are taken as follows:

Left eye view — left shoulder to plate
Right eye view — left shoulder to plate
Left eye view — right shoulder to plate
Right eye view — right shoulder to plate

The X-rays are viewed through a mirror stereoscope, a lensed instrument used to view stereopairs. The X-rays are positioned until they form a stereomodel, i.e., a three-dimensional model formed by the intersecting of an overlapping pair of images. Once a stereomodel is formed, the X-rays are secured in place and, using the stereoscope, the points defining the anatomical coordinate system (Figure 1) are marked on the X-ray for digitization.

The method of head anthropometry used previously required two X-rays, which gave a minimally determined solution for the head anatomic coordinate system. To obtain a better solution it was necessary to expose the subject's head to increased radiation. To avoid this additional exposure, optical photogrammetry is used to determine head anthropometry data. Six photographs are taken using the

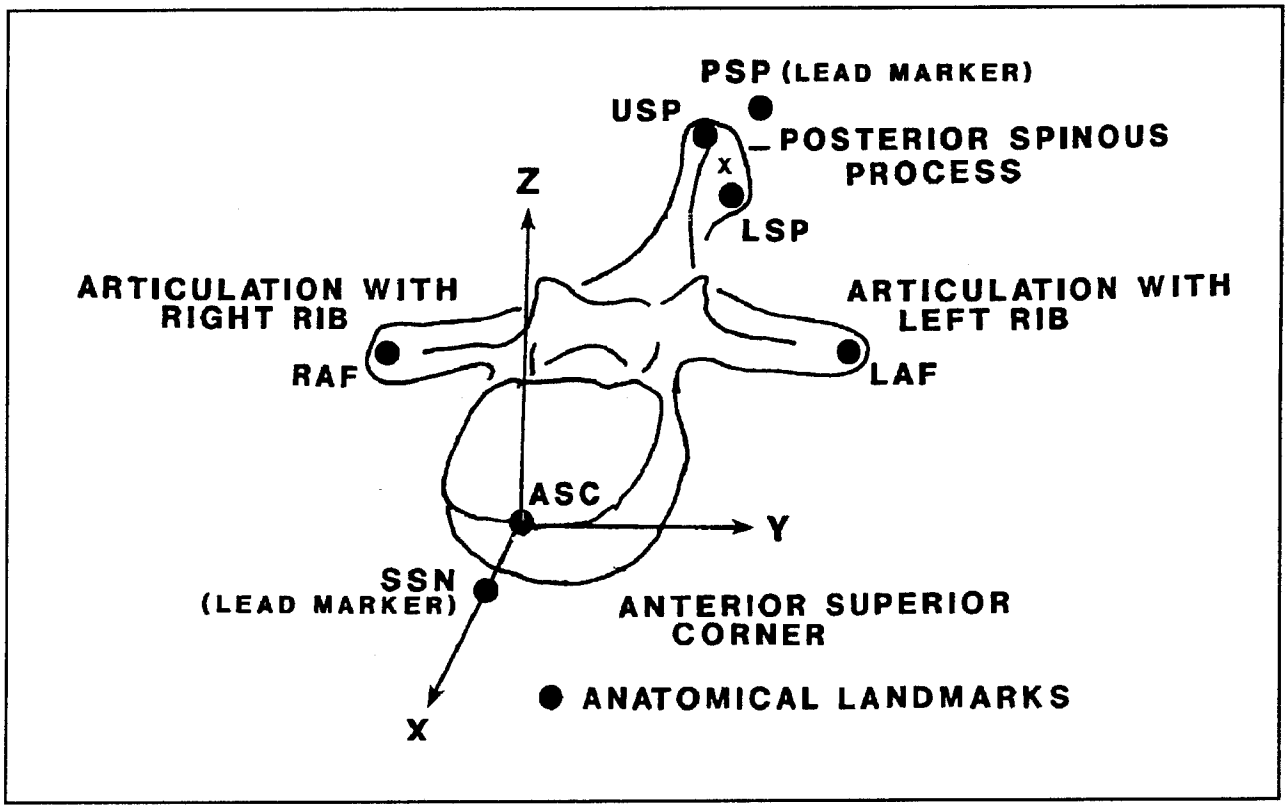


Figure 1. The T_1 Anatomical Coordinate System.

cameras located in the site survey. Photo coordinates are obtained from enlargements using the Altek digitizer.

The optical photogrammetry system used for the initial conditions of accelerator runs is also used for head anthropometry. Control points for a simultaneous block adjustment of the six-camera system have already been determined from the site survey. A test subject is seated on the vertical accelerator chair. The ocular notches are marked with a felt-tip pencil, the mouth mount with BB targets is fitted into place, and ear plugs with the ear targets attached are inserted under a doctor's supervision. All six cameras are fired simultaneously. The film is processed and enlargements made, with prints showing all format edges of each negative. These enlargements are digitized on the Altek digitizer, as described later.

The software package used is NGIANT, a customized version of PC GIANT. PC GIANT is an expanded and enhanced version of the General Integrated Analytical Triangulation program (GIANT), which is a public domain program for mainframe computers. Developed by Elassal et al for Autometric Corporation and later for the U.S. Geological Survey, GIANT will perform a simultaneous bundle adjustment of perspective imagery (photos, X-rays, etc.) by enforcing the collinearity condition. PREP is the pre-processor for transforming comparator coordinates to a plate-centered coordinate system with various corrections for systematic errors. NPREP, a custom version of PREP, was developed by GPA Associates to automate the digitization process and to create the GIANT input image file. NPREP creates the image file for NGIANT for a particular subject by human research volunteer (HRV) number. NGIANT will find all the necessary points in space and compute the locations of the specific body points by regression on the x,y,z coordinates of the targets or known locations. NGIANT then has all the

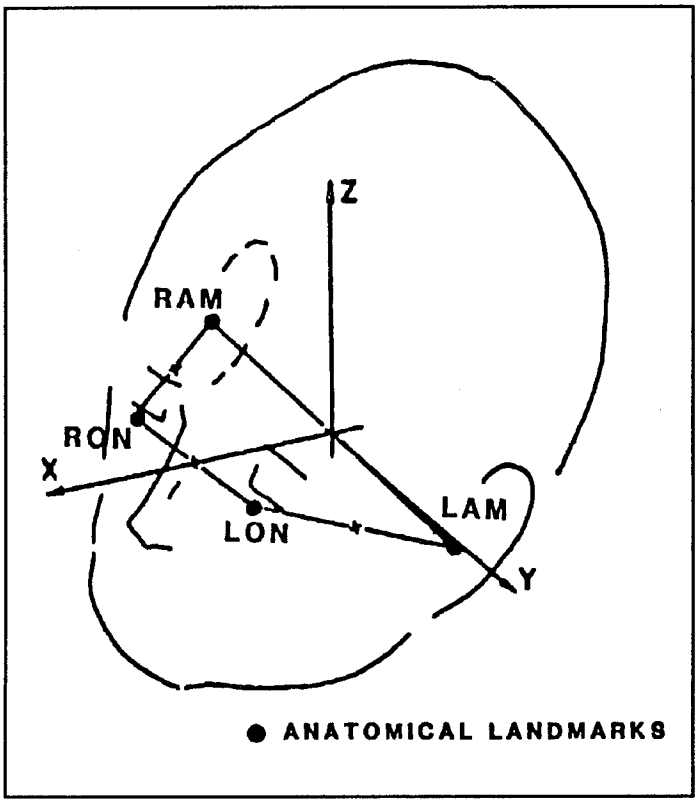


Figure 2. The Head Anatomical Coordinate System.

information to calculate the transformation from anatomical to instrumentation coordinate systems.

Initial conditions data may also be acquired. Recent breakthroughs in the miniaturization of rate gyros and accelerometer sensors have made it apparent that direct measurement of "on-board" human impact dynamics can be easily accomplished. With this in mind, exactly where a subject happens to be at various millisecond points in time is immaterial to the analysis of the biodynamics of the impact. The only position-dependant variables in the subsequent analysis are the initial conditions of the subject some infinitesimal instant before impact. This implies that a simultaneous multiple camera exposure is all that is needed for the photogrammetric determination of initial conditions. The new motion detectors require only that initial conditions be determined for the test subject's position and attitude for both head and neck. The same six cameras are aimed to see targets attached to both head and neck and hence target positions can be obtained photogrammetrically. The cameras are tied in to the firing sequence and are simultaneously exposed a fraction of a second prior to the impact pulse. Enlargements are processed on the Altek digitizer using NPREP. The resulting image file is then read into NGIANT. The output has the locations of the digitized targets on the mouth and T-1 mounts. The particular targets may change with the design of the new sensor package.

Function

The photogrammetric software package consists of two main programs:

NGIANT	-	Main program which executes GIANT and calculates the transformation from the anatomical to the instrumentation coordinate system. All input must already be in place.
NPREP	-	Main Digitization program, which automates the digitization process and creates the NGIANT input image file for a particular subject by HRV number.

ALTEK Digitizer

The ALTEK AC30 digitizer is connected on a bi-directional serial port to a 486 personal computer on the COM2 port. ALTEK Corporation's MICRODIJ Universal Digitizer Software is used to interface the personal computer with the digitizer. The use of MICRODIJ is invisible to the user because all the necessary commands have been incorporated into NPREP. The user need only know how to operate the digitizer cursor. The cursor has a viewing site with a set of cross hairs, and its controls have four push buttons and two warning lights.

The center of the cross hairs on the cursor should be positioned on the center of the point to be digitized. The red light will come on when the cursor is out of the digitizing range. The white light comes on when data has been transmitted. The control buttons are defined as follows:

YELLOW = MISSING
RED = ERROR-BACKUP
GREEN = FIDUCIAL OR DATA POINT
BLUE = ABORT PHOTO

The green button is used to enter data. If a point is missing (i.e., it cannot be seen on a particular photo or X-ray), the yellow button is pressed. The red button is used when mistakes occur. The blue button is also used for mistakes, but only mistakes regarding photographs. If data for the photo being processed is erroneous, the complete data set may be aborted by pressing the blue button. If the wrong point(s) are input, the red button should be pressed to back up until the correct point is reached. All input is displayed on the screen. Data points will be labelled with X and Y coordinates printed. Missing points and deleted (back up) points will be noted. The user just has to watch the screen. Table 1 summarizes the various digitizing input sequences.

NGIANT

NGIANT is an interactive program for executing a customized version of GIANT. All input files should be in place. The operator may select the following options:

0: Initial Conditions
1: Head Anthropometry
2: Body Anthropometry
3: Standard GIANT

After an option has been selected, the appropriate subroutine is executed. If option 0 is selected, the run number is requested. If option 3 is selected, a title for the GIANT output is requested. In both cases, GIANT is executed immediately after input, assuming all input files have been created. If option 1 or 2 is selected, an HRV number is requested. After receiving input, the files are searched for an image file labelled *old* with the given HRV number. If the file exists, GIANT is executed. If the file does not exist, an error will be noted and execution terminated. This is also true for options 0 and 3.

Table 1. Summary of the Various Digitizing Sequences

Initial Conditions	
Fiducials	top 1, top 2, top 3, rt 1, rt 2, rt 3, bot 1, bot 2, bot 3, lft 1, lft 2, lft 3
Targets	mrc1, mrc2, mrc3, mrc4, mrc5, mrc6, mrc7, mrc8, mcc1, mcc2, mcc3, mcc4, mcc5, mcc6, mcc7, mcc8, m1c1, m1c2, m1c3, m1c4, m1c5, m1c6, m1c7, m1c8, nrc1, nrc2, nrc3, nrc4, nrc5, nrc6, nrc7, nrc8, ncc1, ncc2, ncc3, ncc4, ncc5, ncc6, ncc7, ncc8, n1c1, n1c2, n1c3, n1c4, n1c5, n1c6, n1c7, n1c8,
Control	a, b, c, d, f, g, h, j, k, rtc1, rtc2, rtc3, rtc4, rtc5, rtc6, rtc7, rtc8, cen1, cen2, cen3, cen4, cen5, cen6, cen7, cen8, 1fc1, 1fc2, 1fc3, 1fc4, 1fc5, 1fc6, 1fc7, 1fc8
Head Anthropometry	
Fiducials	top 1, top 2, top 3, rt 1, rt 2, rt 3, bot 1, bot 2, bot 3, lft 1, lft 2, lft 3
Targets	ron, lon, ear1-r, ear2-r, ear3-r, ear4-r, ear1-l, ear2-l, ear3-l, ear4-l,
Controls	mrc1, mrc2, mrc3, mrc4, mrc5, mrc6, mrc7, mrc8, mcc1, mcc2, mcc3, mcc4, mcc5, mcc6, mcc7, mcc8, m1c1, m1c2, m1c3, m1c4, m1c5, m1c6, m1c7, m1c8,
Body Anthropometry	
Fiducials	1 2 3 4 5 6 7 8 9 10
Targets	Origin, Rib_1f, Rib_Rt, SpineTop, SpineBot, spine_bb, sternum, 1f_shold, rt_shold, 1neckT, 1neckB, rneckT, rneckB,
Control	r1, r2, r3, r4, r5, r6, r7, r8, c1, c2, c3, c4, c5, c6, c7, c8, 11, 12, 13, 14, 15, 16, 17, 18

NPREP

NPREP is the main digitization and data acquisition program. It interfaces with the ALTEK digitizer to automate the digitization process and creates the NGIANT input image files for a particular subject. The operator may select the following options:

0: Initial Conditions
1: Head Anthropometry
2: Body Anthropometry

To execute NPREP, type NPREP. The COM port number for the Altek digitizer will be requested. Enter the number 2. The screen display will be as follows:

COM2: 9600, 0, 7, 2,-

Enter 0 for initial conditions.
Enter 1 for head anthropometry.
Enter 2 for body anthropometry.

Initial Conditions. If 0 is entered, "enter run number (a6):" will be displayed. The user will enter the run number. "Enter Photo #(1-6, 0 when finished)" will be displayed. The user will enter the number of the photo to be digitized. Finally, the user will be asked to enter specific targets in a predetermined order.

All photos are enlarged with a distinct edge or border so as to depict the area of interest in a well defined block. To establish reference points or calibrated fiducials, three arbitrary measurements are taken in a straight line along the edges of each photo. These are always the first points to be digitized. The sequence is top, right, bottom, and left. The user will be requested to digitize the points as follows:

Enter: top 1 (Digitize 1st point on top edge.)
Enter: top 2
Enter: top 3
Enter: rt 1 (Digitize 1st point on right edge.)
Enter: rt 2
Enter: rt 3
Enter: bot 1 (Digitize 1st point on bottom edge.)
Enter: bot 2
Enter: bot 3
Enter: lft 1
Enter: lft 2
Enter: lft 3 (Digitize last point on left edge.)

The data is analyzed and error values are displayed. The user should check the rms values. These should always be very small, definitely less than 1.0. The user will be given the option to continue. If

the rms values are too large, the user should exit the program and start over.

Once the reference points are entered correctly, the user will be requested to digitized the targets as follows:

Enter:	a	(Digitize target A.)
Enter:	b	
Enter:	c	
Enter:	d	
Enter:	f	
Enter:	g	
Enter:	h	
Enter:	j	
Enter:	k	
Enter:	rtc1	(Digitize corner 1 of right cube.)
Enter:	rtc2	
Enter:	rtc3	
Enter:	rtc4	
Enter:	rtc5	
Enter:	rtc6	
Enter:	rtc7	
Enter:	rtc8	
Enter:	cen1	(Digitize corner 1 of center cube.)
Enter:	cen2	
Enter:	cen3	
Enter:	cen4	
Enter:	cen5	
Enter:	cen6	
Enter:	cen7	
Enter:	cen8	
Enter:	lfc1	(Digitize corner 1 of left cube.)
Enter:	lfc2	
Enter:	lfc3	
Enter:	lfc4	
Enter:	lfc5	
Enter:	lfc6	
Enter:	lfc7	
Enter:	lfc8	

"Press Enter to Continue" is displayed. Press Enter.

Runs before LZ0930 are processed as follows:

Enter:	m-r1	(Digitize corner 1 of cube on right side of mouth mount.)
Enter:	m-r4	(Digitize corner 4 of cube on right side of mouth mount.)
Enter:	m-t1	(Digitize corner 1 of cube on top part of mouth mount.)
Enter:	m-t4	(Digitize corner 4 of cube on top part of mouth mount.)

Enter: m-b1 (Digitize corner 1 of cube on bottom part of mouth mount.)
Enter: m-b4 (Digitize corner 4 of cube on bottom part of mouth mount.)
Enter: m-11 (Digitize corner 1 of cube on left side of mouth mount.)
Enter: m-14 (Digitize corner 4 of cube on left side of mouth mount.)
Enter: t-r1 (Digitize corner 1 of cube on right side T-plate.)
Enter: t-r4 (Digitize corner 4 of cube on right side of T-plate.)
Enter: t-c1 (Digitize corner 1 of cube on center of T-plate.)
Enter: t-c4 (Digitize corner 4 of cube on center of T-plate.)
Enter: t-11 (Digitize corner 1 of cube on left side of T-plate.)
Enter: t-14 (Digitize corner 4 of cube on left side on T-plate.)

Runs LZ0930 through the present are processed as follows:

Enter: mrc1 (Digitize corner 1 of right cube on the mouth mount.)
Enter: mrc2 (Digitize corner 2 of right cube on the mouth mount.)
Enter: mrc3 (Digitize corner 3 of right cube on the mouth mount.)
Enter: mrc4 (Digitize corner 4 of right cube on the mouth mount.)
Enter: mrc5 (Digitize corner 5 of right cube on the mouth mount.)
Enter: mrc6 (Digitize corner 6 of right cube on the mouth mount.)
Enter: mrc7 (Digitize corner 7 of right cube on the mouth mount.)
Enter: mrc8 (Digitize corner 8 of right cube on the mouth mount.)

Enter: mcc1 (Digitize corner 1 of the center cube on the mouth mount.)
Enter: mcc2 (Digitize corner 2 of the center cube on the mouth mount.)
Enter: mcc3 (Digitize corner 3 of the center cube on the mouth mount.)
Enter: mcc4 (Digitize corner 4 of the center cube on the mouth mount.)
Enter: mcc5 (Digitize corner 5 of the center cube on the mouth mount.)
Enter: mcc6 (Digitize corner 6 of the center cube on the mouth mount.)
Enter: mcc7 (Digitize corner 7 of the center cube on the mouth mount.)
Enter: mcc8 (Digitize corner 8 of the center cube on the mouth mount.)

Enter: mlc1 (Digitize corner 1 of the left cube on the mouth mount.)
Enter: mlc2 (Digitize corner 2 of the left cube on the mouth mount.)
Enter: mlc3 (Digitize corner 3 of the left cube on the mouth mount.)
Enter: mlc4 (Digitize corner 4 of the left cube on the mouth mount.)
Enter: mlc5 (Digitize corner 5 of the left cube on the mouth mount.)
Enter: mlc6 (Digitize corner 6 of the left cube on the mouth mount.)
Enter: mlc7 (Digitize corner 7 of the left cube on the mouth mount.)
Enter: mlc8 (Digitize corner 8 of the left cube on the mouth mount.)

Enter: nrc1 (Digitize corner 1 of the right cube on the neck mount.)
Enter: nrc2 (Digitize corner 2 of the right cube on the neck mount.)
Enter: nrc3 (Digitize corner 3 of the right cube on the neck mount.)
Enter: nrc4 (Digitize corner 4 of the right cube on the neck mount.)
Enter: nrc5 (Digitize corner 5 of the right cube on the neck mount.)
Enter: nrc6 (Digitize corner 6 of the right cube on the neck mount.)

Enter: nrc7 (Digitize corner 7 of the right cube on the neck mount.)
Enter: nrc8 (Digitize corner 8 of the right cube on the neck mount.)

Enter: ncc1 (Digitize corner 1 of the center cube on the neck mount.)
Enter: ncc2 (Digitize corner 2 of the center cube on the neck mount.)
Enter: ncc3 (Digitize corner 3 of the center cube on the neck mount.)
Enter: ncc4 (Digitize corner 4 of the center cube on the neck mount.)
Enter: ncc5 (Digitize corner 5 of the center cube on the neck mount.)
Enter: ncc6 (Digitize corner 6 of the center cube on the neck mount.)
Enter: ncc7 (Digitize corner 7 of the center cube on the neck mount.)
Enter: ncc8 (Digitize corner 8 of the center cube on the neck mount.)

Enter: nlc1 (Digitize corner 1 of the left cube on the neck mount.)
Enter: nlc2 (Digitize corner 2 of the left cube on the neck mount.)
Enter: nlc3 (Digitize corner 3 of the left cube on the neck mount.)
Enter: nlc4 (Digitize corner 4 of the left cube on the neck mount.)
Enter: nlc5 (Digitize corner 5 of the left cube on the neck mount.)
Enter: nlc6 (Digitize corner 6 of the left cube on the neck mount.)
Enter: nlc7 (Digitize corner 7 of the left cube on the neck mount.)
Enter: nlc8 (Digitize corner 8 of the left cube on the neck mount.)

"Enter Photo # (1-6, 0 when finished)" will be displayed at the end of processing. Repeat the above steps for each photo to be digitized. Enter 0 at this prompt when you have digitized the last photo.

Head Anthropometry. After entering the number 1 as the processing option, the display will be: "Enter HRV number." The user will enter a four digit integer as the human research volunteer number (i.e., 0222 for HRV number H-222). The following will be printed: "Default ear offsets are: 5.420″, 5.420″, OK?" Press the RETURN key to accept these defaults, any other key to change them. If the user presses RETURN, processing will continue. "Enter left and right ear offsets:" will be displayed if anything else is entered. The user will be given this information before processing.

The files are then searched to insure that new data is being processed. If data for the given subject exists, the program will terminate and the user will be notified that the data already exists. If the data does not exist, the user will be requested to digitize the points as follows:

The edges, targets A-K, the right cube corners, the center cube corners, and the left cube corners are digitized in the same sequence as for initial conditions. (See Initial Conditions section, page 6). The head anthropometry data is requested after all reference points have been digitized. The input for runs before LZ0930 is as follows:

Enter: rtp (Digitize right side of T-plate.)
Enter: ctp (Digitize center of T-plate.)
Enter: ltp (Digitize left side of T-plate.)
Enter: ron (Digitize right orbital notch (eye).)
Enter: lon (Digitize left orbital notch (eye).)
Enter: ear1-r (Digitize right ear target farthest away from head.)
Enter: ear2-r (Digitize 2nd farthest right ear target.)

Enter: ear3-r (Digitize 2nd closest right ear target.)
Enter: ear4-r (Digitize right ear target closest to head.)
Enter: ear1-l (Digitize left ear target farthest away from head.)
Enter: ear2-l (Digitize 2nd farthest left ear target.)
Enter: ear3-l (Digitize 2nd closest left ear target.)
Enter: ear4-l (Digitize left ear target closest to head.)

Runs from LZ0930 and above are processed as follows:

Enter: ron (Digitize right orbital notch eye).)
Enter: lon (Digitize left orbital notch (eye).)
Enter: ear1-r (Digitize right ear target farthest away from head.)
Enter: ear2-r (Digitize 2nd farthest right ear target.)
Enter: ear3-r (Digitize 2nd closest right ear target.)
Enter: ear4-r (Digitize right ear target closest to head.)
Enter: ear1-l (Digitize left ear target farthest away from head.)
Enter: ear2-l (Digitize 2nd farthest left ear target.)
Enter: ear3-l (Digitize 2nd closest left ear target.)
Enter: ear4-l (Digitize left ear target closest to head.)
Enter: mrc1 (Digitize corner 1 of the right cube on the mouth mount.)
Enter: mrc2 (Digitize corner 2 of the right cube on the mouth mount.)
Enter: mrc3 (Digitize corner 3 of the right cube on the mouth mount.)
Enter: mrc4 (Digitize corner 4 of the right cube on the mouth mount.)
Enter: mrc5 (Digitize corner 5 of the right cube on the mouth mount.)
Enter: mrc6 (Digitize corner 6 of the right cube on the mouth mount.)
Enter: mrc7 (Digitize corner 7 of the right cube on the mouth mount.)
Enter: mrc8 (Digitize corner 8 of the right cube on the mouth mount.)
Enter: mcc1 (Digitize corner 1 of the center cube on the mouth mount.)
Enter: mcc2 (Digitize corner 2 of the center cube on the mouth mount.)
Enter: mcc3 (Digitize corner 3 of the center cube on the mouth mount.)
Enter: mcc4 (Digitize corner 4 of the center cube on the mouth mount.)
Enter: mcc5 (Digitize corner 5 of the center cube on the mouth mount.)
Enter: mcc6 (Digitize corner 6 of the center cube on the mouth mount.)
Enter: mcc7 (Digitize corner 7 of the center cube on the mouth mount.)
Enter: mcc8 (Digitize corner 8 of the center cube on the mouth mount.)

Enter: mlc1 (Digitize corner 1 of the left cube on the mouth mount.)
Enter: mlc2 (Digitize corner 2 of the left cube on the mouth mount.)
Enter: mlc3 (Digitize corner 3 of the left cube on the mouth mount.)
Enter: mlc4 (Digitize corner 4 of the left cube on the mouth mount.)
Enter: mlc5 (Digitize corner 5 of the left cube on the mouth mount.)
Enter: mlc6 (Digitize corner 6 of the left cube on the mouth mount.)
Enter: mlc7 (Digitize corner 7 of the left cube on the mouth mount.)
Enter: mlc8 (Digitize corner 8 of the left cube on the mouth mount.)

"Enter photo #(1-6, 0 when finished)" will be displayed at the end of processing. Repeat the above

steps for each photo to be digitized. Enter 0 to this prompt when you have digitized the last photo.

Body (Neck) Anthropometry. As discussed earlier, the neck anthropometry is obtained from X-rays. This will be referred to as *body anthropometry* because in this new procedure more than the neck is considered. After the number 2 is entered as the processing option, the display will be: "Enter HRV number." The user will enter a four digit integer as the HRV number (i.e., 0222 would be entered for HRV number H-222). If a data file exists for the given subject, the program will terminate with a file error. No specific details will be relayed to the user. If the data does not exist, processing will continue and the following will be displayed: "Enter number of parameters for shrinkage fit:" The user will input the number 8, and the following will appear:

Enter 0 when finished
Enter 1 if: Left eye view-left shoulder to plate
Enter 2 if: Right eye view-left shoulder to plate
Enter 3 if: Left eye view-right shoulder to plate
Enter 4 if: Right eye view-right shoulder to plate

The number to be entered is determined by the X-ray being digitized. The numbers 1 through 4 represent the four X-rays discussed earlier. The T-1 anatomical coordinate system (Figure 1) should have been marked on these X-rays in stereo before digitization. The user will be requested to digitize the points as outlined in Figure 3 or Figure 4.

Fiducials 1 through 10 are entered first. The user must follow the sequence indicated in Figures 3 and 4. There is no prompting. However, the data entered is printed on the screen to ensure proper entry. The user must check the screen to verify correct digitization.

The input will be as follows:

Fiducial 1 (Input carefully; you will have to re-enter it to close out.)
.
.
.
Fiducial 10

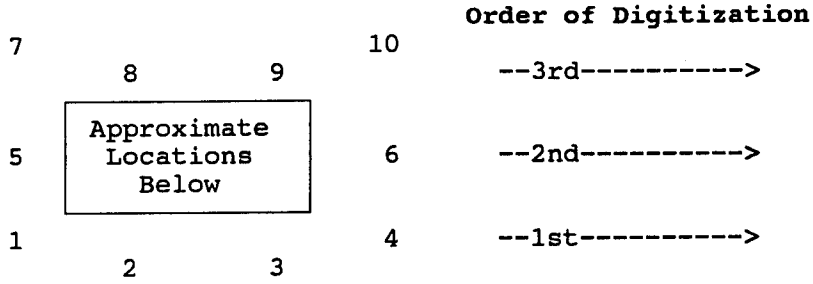
As with the others, an error value will be printed. Check the rms value; it must be less than one. If not, the data is erroneous and you must start over.

Runs before LZ0930 are processed as follows:

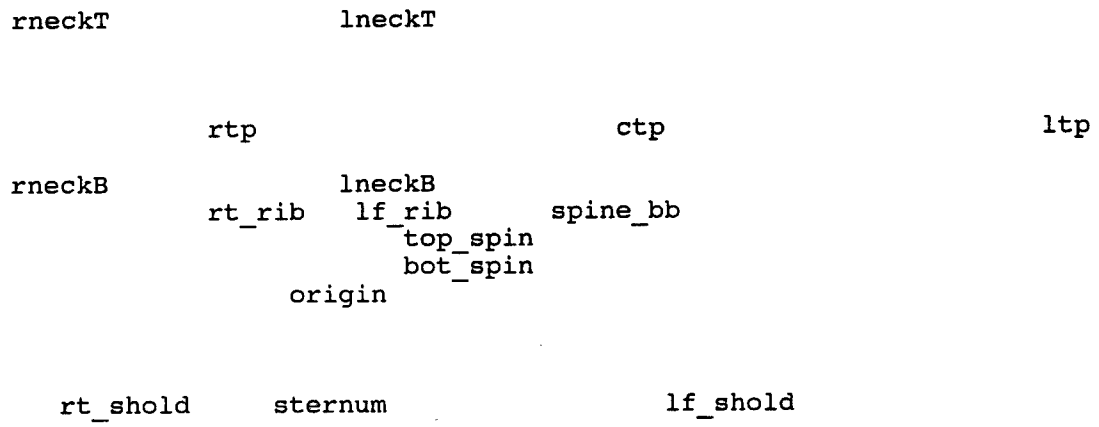
Origin	
Rib-lf	(Left Rib Articulation)
Rib-rt	(Right Rib Articulation)
Spine Top	(Top Spinous Process)
Spine Bot	(Bottom Spinous Process)
Spine-bb	(Posterior Spinous Process)
Sternum	
lf-shold	(Left Shoulder)
rt-shold	(Right Shoulder)

VIEW OF AN X-RAY

Locations of Fiducials on X-ray



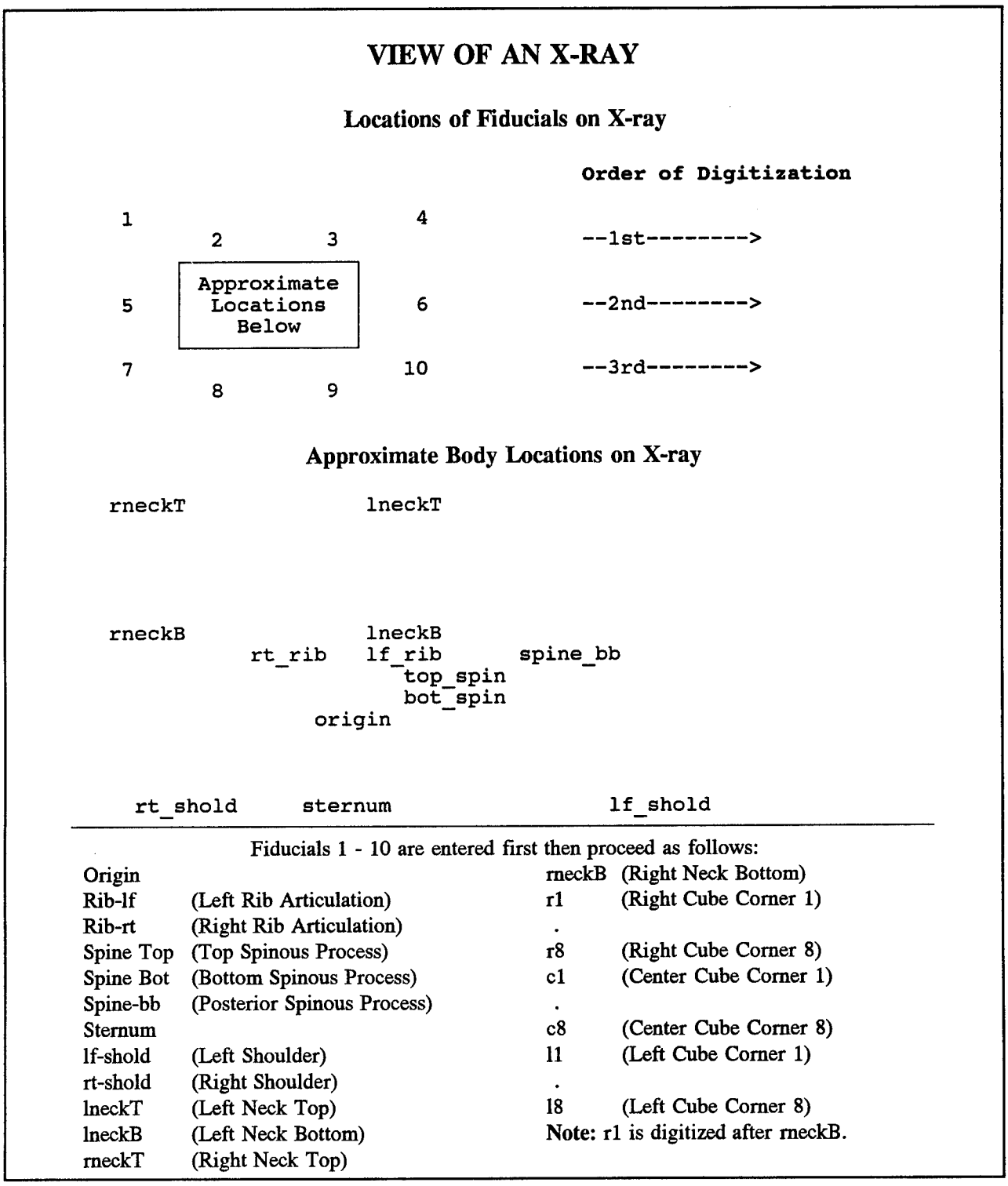
Approximate Body Locations on X-ray



Fiducials 1 - 10 are entered first then proceed as follows:

Origin		ltp	(Left Side of T-Plate)
Rib-lf	(Left Rib Articulation)	rtp	(Right side of T-Plate)
Rib-rt	(Right Rib Articulation)	ctp	(Center of T-Plate)
Spine Top	(Top Spinous Process)	lneckT	(Left Neck Top)
Spine Bot	(Bottom Spinous Process)	lneckB	(Left Neck Bottom)
Spine-bb	(Posterior Spinous Process)	rneckT	(Right Neck Top)
Sternum		rneckB	(Right Neck Bottom)
lf-shold	(Left Shoulder)		
rt-shold	(Right Shoulder)		

Figure 3. X-ray anthropometry digitization schematic diagram: Pre-mount modification — T-plate.



Fiducials 1 - 10 are entered first then proceed as follows:

Origin		rneckB	(Right Neck Bottom)
Rib-lf	(Left Rib Articulation)	r1	(Right Cube Corner 1)
Rib-rt	(Right Rib Articulation)	.	
Spine Top	(Top Spinous Process)	r8	(Right Cube Corner 8)
Spine Bot	(Bottom Spinous Process)	c1	(Center Cube Corner 1)
Spine-bb	(Posterior Spinous Process)	.	
Sternum		c8	(Center Cube Corner 8)
lf-shold	(Left Shoulder)	l1	(Left Cube Corner 1)
rt-shold	(Right Shoulder)	.	
lneckT	(Left Neck Top)	l8	(Left Cube Corner 8)
lneckB	(Left Neck Bottom)	**Note:** r1 is digitized after rneckB.	
rneckT	(Right Neck Top)		

Figure 4. X-ray Anthropometry Digitizing Schematic Diagram: Post Mount Modification — No T-plate.

ltp	(Left Side of T-Plate)
rtp	(Right side of T-Plate)
ctp	(Center of T-Plate)
lneckT	(Left Neck Top)
lneckB	(Left Neck Bottom)
rneckT	(Right Neck Top)
rneckB	(Right Neck Bottom)

Re-do first fiducial (Re-digitize the first point you digitized)

Runs from LZ0930 and above are processed as follows:

Origin	
Rib-lf	(Left Rib Articulation)
Rib-rt	(Right Rib Articulation)
Spine Top	(Top Spinous Process)
Spine Bot	(Bottom Spinous Process)
Spine-bb	(Posterior Spinous Process)
Sternum	
lf-shold	(Left Shoulder)
rt-shold	(Right Shoulder)
lneckT	(Left Neck Top)
lneckB	(Left Neck Bottom)
rneckT	(Right Neck Top)
rneckB	(Right Neck Bottom)
r1	(Right Cube Corner 1)
r2	(Right Cube Corner 2)
r3	(Right Cube Corner 3)
r4	(Right Cube Corner 4)
r5	(Right Cube Corner 5)
r6	(Right Cube Corner 6)
r7	(Right Cube Corner 7)
r8	(Right Cube Corner 8)
c1	(Center Cube Corner 1)
c2	(Center Cube Corner 2)
c3	(Center Cube Corner 3)
c4	(Center Cube Corner 4)
c5	(Center Cube Corner 5)
c6	(Center Cube Corner 6)
c7	(Center Cube Corner 7)
c8	(Center Cube Corner 8)
11	(Left Cube Corner 1)
12	(Left Cube Corner 2)

13 (Left Cube Corner 3)
14 (Left Cube Corner 4)
15 (Left Cube Corner 5)
16 (Left Cube Corner 6)
17 (Left Cube Corner 7)
18 (Left Cube Corner 8)

Re-do first fiducial (Re-digitize the first point you digitized)

Repeat the above steps for each X-ray.

Note that the user should be especially careful when digitizing fiducial 1. This is the close-out reference point. The first and last the data points entered are compared to check the accuracy of the data. If the difference between the two is too great, the user will be given four tries to read the point correctly. After four tries, the program will terminate and all the data will have to be re-entered.

Additional Information. Mounts similar to those shown in Figures 5 and 6 have been used on the mouth and neck to gain initial conditions, head anthropometry, and body anthropometry data. All references to right and left, for both photos and X-rays, are with respect to the subject. The right cube is on the subject's right and the left cube on the subject's left. The cubes are numbered as shown in Figure 7. The mount is in a different position when on the neck. Figure 8 shows the position of the mount when on the neck (lying down). Note that the numbering of the corners of the cubes have not changed. Only the positions of the cubes have changed.

Programs

The following program and subroutines are available:

DIGITIZE	— Main digitization program which digitizes data and creates the GIANT image data files (NPREP).
HEAD	— Digitizes head anthropometry and initial conditions.
BODY	— Digitizes body anthropometry.
FID	— Determines corner fiducials.
FOURP	— Calculates the three- or four-parameter transformations.
FIVEP	— Calculates the five-parameter transformation.
SIXP	— Calculates the six-parameter transformation.
EIGHTP	— Calculates the eight-parameter transformation.

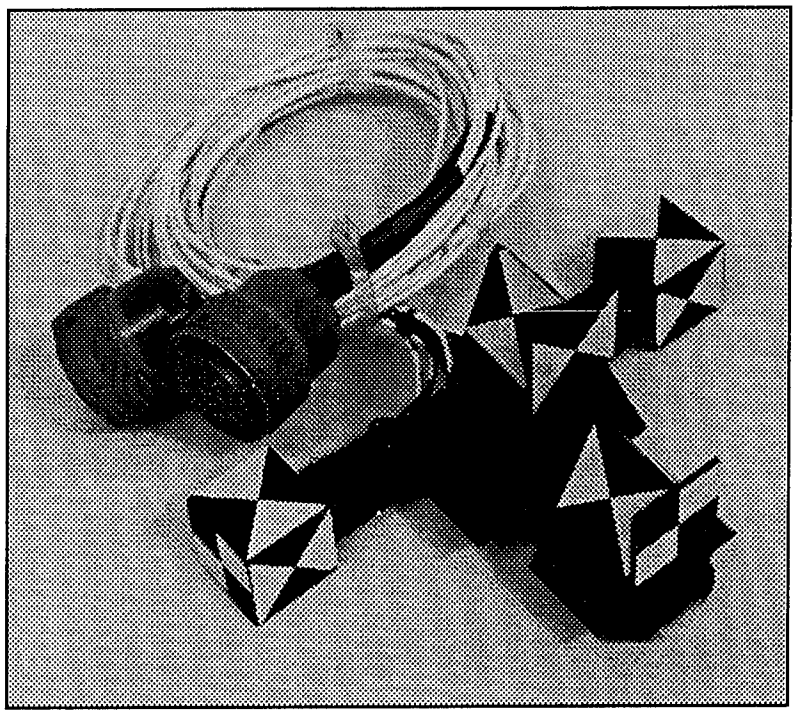


Figure 5. T-Plate Mount.

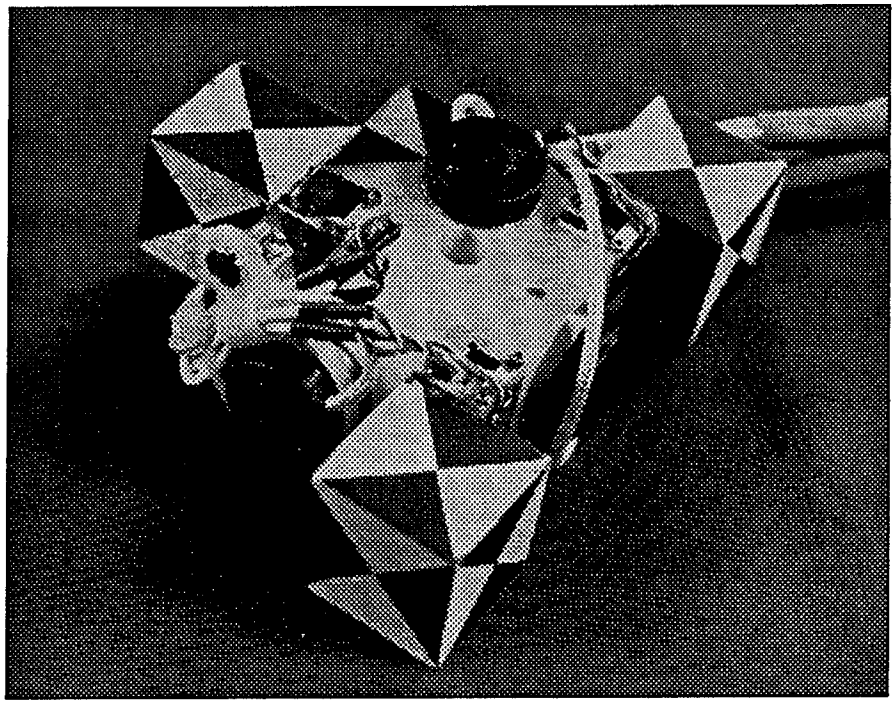


Figure 6. Photogrammetric Mount.

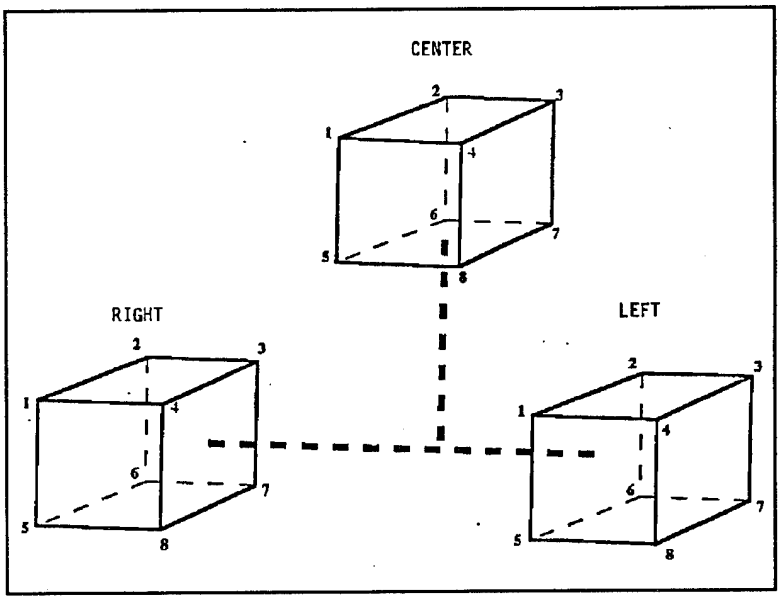


Figure 7. Corner Designations for Photogrammetry: Position on Mouth.

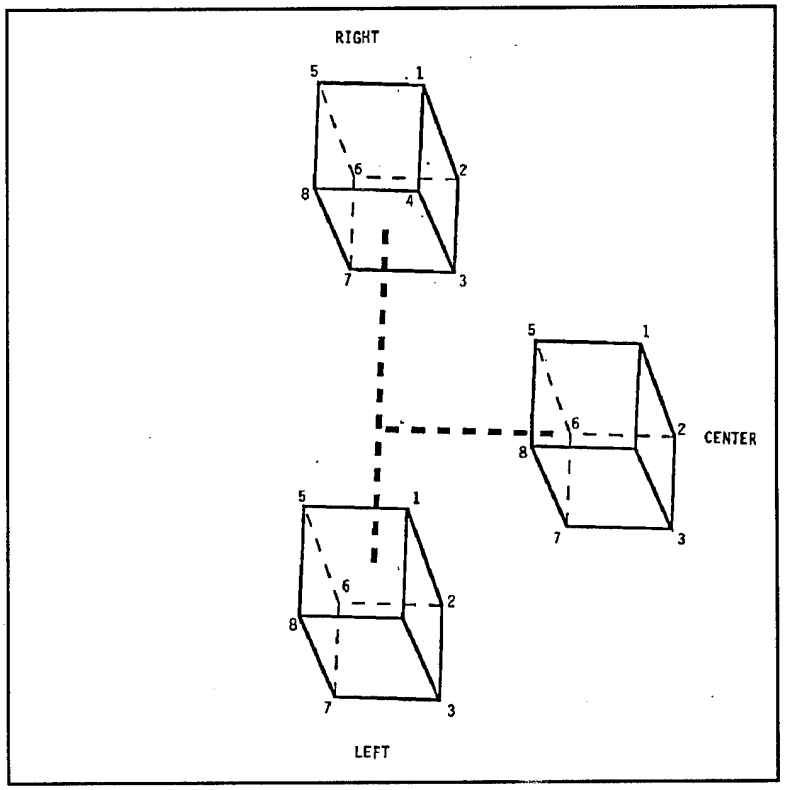


Figure 8. Corner Designations for Photogrammetry: Position of Neck.

ACCAPR	— Acquires approximate values of the eight-parameter transformation.
ACCNEQ	— Acquires normal equations for the eight-parameter transformation.
INVERT	— Finds the inverse of a matrix.
LINSOL	— Solves linear equations.
CLEAR	— Clears the screen and moves the cursor to row 8.
NEWPAG	— Writes title and page number.

Subroutine Descriptions

HEADS. The HEADS routine allows the operator to digitize head anthropometry or initial conditions photos. The call is:

CALL HEADS(IANS)

where

IANS = 0 for digitization of initial conditions
= 1 for digitization of head anthropometry

BODY. The BODY routine allows the operator to digitize body anthropometry X-rays. The call is:

CALL BODY

FID. The FID routine intersects the edge lines formed by a least squares solution on three points to give the corner fiducials. It also stores the output in the same array used for input. The call is:

CALL FID(Z)

where

Z = X, Y coordinates of three points along the four edges of the photo when Z is the input.

= The corner fiducials coordinates when Z is the output.

FOURP. The FOURP routine calculates the three- and four-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL FOURP

FIVEP. The FIVEP routine calculates the five-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL FIVEP

SIXP. The SIXP routine calculates the six-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL SIXP

EIGHTP. The EIGHTP routine calculates the eight-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL EIGHTP

ACCAPR. The ACCAPR routine evaluates the contribution of one point to the 8 × 9 matrix of normal equations for computation of approximate values of the eight-parameter film shrinkage transformation. The call is:

CALL ACCAPR(XG,YG,XP,YP)

where

XG = Calibrated X fiducial coordinate
YG = Calibrated Y fiducial coordinate
XP = Observed X fiducial coordinate
YP = Observed Y fiducial coordinate

EQN = 8 × 8 coefficient matrix of the Normal Equation with the vector of constants in column 9

ACCNEQ. The ACCNEQ routine evaluates the contribution of one point to the normal equation required for subroutine EIGHTP. The normal equations are required to compute corrections to the last estimate of the eight-transformation parameters. This routine is called once for each point. The call is:

CALL ACCNEQ(XG,YG,XP,YP)

where

XG = Calibrated X fiducial coordinate
YG = Calibrated Y fiducial coordinate
XP = Observed X fiducial coordinate
YP = Observed Y fiducial coordinate
EQN = 8 × 8 coefficient matrix of the Normal Equation with the vector of constants in column 9

INVERT. The INVERT routine finds the inverse of a matrix by the Gaussian Elimination Method. The routine will search for the largest non-singular matrix in the input array, invert it, and return the inverse in the same array. The call is:

CALL INVERT(A,N,D)

where

A = Array in which the matrix to be inverted is located and also the location of the inverted matrix that is returned.
N = The first dimension of array A when used in the call statement. It contains the rank of the largest matrix contained in A as a returned value.
D = The determinant of the largest non-singular matrix in A.

LINSOL. The LINSOL routine solves a specified number of linear equations with a specified number of unknowns. The call is:

CALL LINSOL(NPAR)

where

NPAR = The number of linear equations and the number of unknowns

CLEAR. The CLEAR routine clears the screen and moves the cursor to row eight. The call is:

CALL CLEAR

NEWPAG. The NEWPAG routine prints the title, page number, and any header information on each page. The call is:

CALL NEWPAG

Giant Subroutines Customized for NAVBIODYNLAB

Several subroutines were added to GIANT to enhance the program for use by NAVBIODYNLAB. These include the following subroutines:

ANTHRO	—	Verifies that the needed 13 head or 8 body points are available. This routine finds the transformations and prints the results.
EXTRAPOLATE	—	Extrapolates anthropometry data.
GETICV	—	Searches object point IDs for matching IDs of targets on the head, mouth, and neck. Desired variables are saved for the initial conditions data file.
ICONS	—	Writes initial conditions data to a file.
NBDL	—	Finds the origin and transformation matrices of the mount relative to the head/body anatomical origin in the anatomical coordinate system.
STUFFP	—	Searches object point IDs to find matching IDs in the anthropometry list and stores object point data in corresponding locations in an array.
UVEC	—	This routine creates a unit vector.

Reference

Becker, E. B., "Stereoradiographic Measurements for Anatomically Mounted Instruments," *Proceedings of the Twenty-First STAPP Car Crash Conference*, Society of Automotive Engineers, Inc., Warrendale, PA, pp. 477-505, October, 1977.

Appendixes

Appendix A
Listings of Prep Output Files

Body Anthropometry Printed Output

Naval BioDynamics Laboratory PREP Page 1
Body Anthropometry for HRV # 00253 Date: 10/08/92

Calibrated Fiducial Coordinates of Frame LfEyLfSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600
9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP Page 2
Body Anthropometry for HRV # 00253 Date: 10/08/92

Fiducial Measurements of Frame LfEyLfSh

ID	Measured	
	X	Y
1	79.426	328.828
2	193.294	343.332
3	348.945	345.897
5	80.645	175.463
6	466.141	177.749
8	195.428	33.884
9	350.190	37.135

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	-0.138	0.080
2	0.169	-0.090
3	-0.068	-0.045
5	0.013	-0.034
6	0.058	0.168

8	0.094	0.138
9	-0.127	-0.216
Rms	0.108	0.126
Rms(check)	0.300	0.206

Transformation Parameters Are:

1.001305	0.005593	-275.7444	-0.000006	0.000006
-0.004836	1.000885	-180.2756		

Naval BioDynamics Laboratory PREP Page 3
Body Anthropometry for HRV # 00253 Date:10/08/92

Plate Coordinates for Frame LfEyLfSh

ID	Measured		Adjusted	
	X	Y	X	Y
Origin	392.684	196.063	118.707	14.080
Rib_Lf	392.405	185.572	118.376	3.568
Rib_Rt	343.433	206.654	69.359	24.925
SpineTop	306.248	199.390	32.043	17.823
SpineBot	302.311	189.509	28.043	7.946
spine_bb	276.987	197.028	2.708	15.596
sternum	404.876	100.863	130.484	-81.443
lf_shold	304.571	91.186	29.776	-90.609
lneckT	284.099	232.283	10.029	50.860
lneckB	282.245	164.922	7.797	-16.586
rneckT	94.056	242.087	-180.056	61.518
rneckB	93.091	160.071	-181.569	-20.506
r1	208.661	284.251	-65.197	103.179
r2	209.423	258.293	-64.590	77.216
r3	217.449	261.341	-56.539	80.230
r4	218.694	296.418	-55.086	115.302
r5	229.387	281.711	-44.472	100.553
r6	230.226	256.184	-43.783	75.017
r7	241.859	260.071	-32.115	78.854
r8	242.087	294.361	-31.688	113.149
c1	193.192	281.940	-80.686	100.933
c2	192.557	255.448	-81.482	74.444
c3	198.933	261.163	-75.069	80.132
c4	200.990	294.589	-72.809	113.547
c5	212.801	280.238	-61.078	99.149
c6	212.928	254.991	-61.102	73.898
c7	223.520	259.740	-50.473	78.603
c8	223.291	290.805	-50.519	109.671
l1	279.654	285.420	5.871	104.052
l2	279.070	257.099	5.129	75.719
l3	298.475	258.953	24.577	77.490
l4	299.796	287.757	26.057	106.306
l5	298.298	283.464	24.533	102.017
l6	297.967	256.210	24.053	74.747
l7	318.389	256.896	44.519	75.345
l8	317.170	285.725	43.451	104.200

Naval BioDynamics Laboratory PREP Page 4
Body Anthropometry for HRV # 00253 Date: 10/08/92

Calibrated Fiducial Coordinates of Frame RtEyLfSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600
9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP Page 5
Body Anthropometry for HRV # 00253 Date: 10/08/92

Fiducial Measurements of Frame RtEyLfSh

ID	Measured	
	X	Y
1	112.192	337.490
2	226.136	351.282
3	382.219	352.704
4	498.500	336.982
5	111.684	184.302
6	498.780	183.007
8	225.273	41.123
9	380.670	42.901

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	-0.082	0.030
2	0.160	-0.046
3	-0.189	-0.065
4	0.140	-0.026
5	-0.053	0.057
6	0.000	0.180
8	0.179	0.011
9	-0.155	-0.141
Rms	0.135	0.089
Rms(check)	0.374	0.200

Transformation Parameters Are:

1.000134	-0.004064	-305.1258	0.000006	0.000002
0.004181	1.001018	-189.9147		

Naval BioDynamics Laboratory PREP — Page 6
Body Anthropometry for HRV # 00253 — Date: 10/08/92

Plate Coordinates for Frame RtEyLfSh

ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Origin	341.097	196.774	35.129	8.464
Rib_Lf	342.113	187.020	36.183	-1.271
Rib_Rt	293.040	209.525	-12.869	21.002
SpineTop	267.945	208.229	-37.913	19.606
SpineBot	263.195	198.425	-42.616	9.793
spine_bb	237.922	205.613	-67.880	16.871
sternum	351.790	107.417	46.164	-80.724
lf_shold	277.038	98.222	-28.395	-90.261
lneckT	257.962	240.386	-48.006	51.687
lneckB	254.991	172.872	-50.706	-15.770
r1	175.108	293.167	-130.970	104.111
r2	175.616	267.106	-130.363	78.073
r3	175.920	271.221	-130.075	82.186
r4	177.902	306.375	-128.229	117.318
r5	197.510	290.474	-108.576	101.500
r6	198.069	265.354	-107.921	76.405
r7	201.498	269.418	-104.511	80.478
r8	202.743	303.886	-103.401	114.917
c1	161.087	291.236	-144.976	102.133
c2	160.350	264.465	-145.610	75.377
c3	159.360	271.018	-146.625	81.922
c4	161.366	304.216	-144.745	115.104
c5	181.940	289.001	-124.127	99.973
c6	181.940	263.855	-124.031	74.847
c7	185.268	269.138	-120.726	80.139
c8	185.293	300.152	-120.820	111.126
l1	245.567	293.878	-60.593	105.070
l2	244.500	265.557	-61.547	76.779
l3	262.661	267.106	-43.421	78.394
l4	264.160	295.885	-42.040	107.139
l5	265.633	291.440	-40.552	102.705
l6	264.719	264.109	-41.356	75.408
l7	283.591	264.744	-22.521	76.112
l8	282.956	293.370	-23.270	104.694

Naval BioDynamics Laboratory PREP — Page 7
Body Anthropometry for HRV # 00253 — Date: 10/08/92

Calibrated Fiducial Coordinates of Frame LfEyRtSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600

9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP Page 8
Body Anthropometry for HRV # 00253 Date: 10/08/92

Fiducial Measurements of Frame LfEyRtSh

ID	Measured X	Measured Y
2	215.011	356.464
3	370.840	356.108
4	486.004	339.065
5	99.162	190.627
6	484.683	185.598
8	210.871	46.711
9	366.039	47.523

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
2	0.015	0.041
3	-0.079	0.004
4	0.045	-0.040
5	0.039	-0.015
6	0.008	-0.003
8	-0.043	-0.048
9	0.015	0.060
Rms	0.041	0.037
Rms(check)	0.225	0.203

Transformation Parameters Are:

1.001048	-0.014627	-290.4377	-0.000005	0.000005
0.013654	1.000787	-197.1577		

Naval BioDynamics Laboratory PREP Page 9
Body Anthropometry for HRV # 00253 Date: 10/08/92

Plate Coordinates for Frame LfEyRtSh

ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Origin	206.248	200.685	-86.914	6.502
Rib_Lf	266.852	203.327	-26.289	9.976
Rib_Rt	212.268	198.171	-80.854	4.068
SpineTop	280.289	209.982	-12.931	16.823
SpineBot	284.277	201.066	-8.808	7.952
spine_bb	317.627	217.221	24.357	24.583
sternum	185.445	127.076	-106.689	-67.469
rt_shold	291.948	104.546	0.287	-88.623
rneckT	318.668	245.110	24.989	52.517
rneckB	318.414	177.368	25.734	-15.313
r1	297.764	306.019	3.162	113.169
r2	298.221	274.447	4.082	81.590
r3	318.338	273.583	24.238	81.008
r4	315.824	301.981	21.302	109.385

r5	281.203	303.606	-13.380	110.520
r6	279.832	272.872	-14.305	79.756
r7	298.552	271.907	4.450	79.053
r8	298.247	301.117	3.717	108.272
c1	386.156	299.517	91.784	107.917
c2	386.080	274.701	92.081	83.079
c3	403.809	271.602	109.895	80.226
c4	402.768	296.977	108.468	105.610
c5	366.217	297.815	71.834	105.931
c6	365.455	272.847	71.444	80.933
c7	383.794	270.104	89.860	78.444
c8	383.388	295.427	89.072	103.785
l1	372.212	313.487	77.604	121.698
l2	373.050	282.194	78.913	90.395
l3	391.566	280.873	97.486	89.334
l4	390.525	310.591	95.994	119.061
l5	352.222	310.744	57.622	118.669
l6	350.647	280.873	56.489	88.757
l7	370.586	278.663	76.497	86.827
l8	369.875	308.204	75.342	116.378

Naval BioDynamics Laboratory PREP Page 10
Body Anthropometry for HRV # 00253 Date: 10/08/92

Calibrated Fiducial Coordinates of Frame RtEyRtSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600
9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP Page 11
Body Anthropometry for HRV # 00253 Date: 10/08/92

Fiducial Measurements of Frame RtEyRtSh

ID	Measured	
	X	Y
2	191.770	344.272
3	347.193	350.647
4	462.991	338.658
5	83.033	173.711
6	468.249	185.293
8	201.092	34.976
9	356.235	42.723

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
2	0.153	-0.009

3	-0.19	0.034
4	0.09	0.077
5	-0.02	-0.026
6	-0.100	-0.192
8	-0.111	-0.032
9	0.175	0.148
Rms	0.133	0.098
Rms(check)	0.329	0.391

Transformation Parameters Are:

0.999771	0.029486	-282.0947	-0.000010	0.000005
-0.029919	1.000464	-176.3431		

Naval BioDynamics Laboratory PREP Page 12
Body Anthropometry for HRV # 00253 Date: 10/08/92

Plate Coordinates for Frame RtEyRtSh

ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Origin	134.137	188.671	-142.475	8.405
Rib_Lf	189.611	189.611	-87.014	7.690
Rib_Rt	139.954	183.007	-136.836	2.563
SpineTop	201.752	197.358	-74.642	15.085
SpineBot	212.700	189.738	-63.920	7.127
spine_bb	249.682	207.696	-26.382	24.012
sternum	114.097	111.735	-164.820	-68.008
rt_shold	241.376	95.606	-38.026	-88.080
lneckT	448.894	258.318	174.851	68.876
lneckB	448.818	175.539	172.400	-14.200
rneckT	260.883	236.753	-14.309	52.786
rneckB	263.627	169.037	-13.568	-15.141
r1	227.457	294.919	-46.027	111.989
r2	229.667	263.982	-44.737	80.963
r3	250.800	263.601	-23.606	79.966
r4	246.786	292.125	-26.776	108.635
r5	212.242	291.821	-61.332	109.327
r6	212.979	260.680	-61.525	78.145
r7	232.385	260.985	-42.108	77.884
r8	230.302	290.373	-43.317	107.357
c1	316.713	292.735	43.246	107.224
c2	317.805	267.614	43.604	82.030
c3	336.829	266.040	62.624	79.897
c4	334.467	291.490	61.000	105.464
c5	297.713	290.195	24.142	105.230
c6	298.577	265.405	24.278	80.378
c7	317.475	263.322	43.148	77.740
c8	316.078	288.442	42.484	102.944
l1	296.748	306.095	23.643	121.179
l2	299.364	275.488	25.363	90.454
l3	318.973	274.803	44.986	89.197
l4	316.332	304.038	43.196	118.555
l5	278.155	302.997	4.937	118.612
l6	278.790	272.745	4.680	88.306
l7	299.568	271.653	25.454	86.607
l8	297.002	300.330	23.728	115.399

Body Anthropometry Image Data File

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LfEyLfSh     -838.200      1.000     1.000
Origin        118.7074    14.0804              Photo LfEyLfSh
Rib_Lf        118.3758     3.5684              Photo LfEyLfSh
*Rib_Rt        69.3593    24.9248              Photo LfEyLfSh
SpineTop       32.0426    17.8235              Photo LfEyLfSh
SpineBot       28.0431     7.9459              Photo LfEyLfSh
spine_bb        2.7075    15.5963              Photo LfEyLfSh
sternum       130.4842   -81.4432              Photo LfEyLfSh
*lf_shold      29.7763   -90.6093              Photo LfEyLfSh
lneckT         10.0286    50.8605              Photo LfEyLfSh
lneckB          7.7974   -16.5859              Photo LfEyLfSh
rneckT       -180.0564    61.5182              Photo LfEyLfSh
rneckB       -181.5693   -20.5057              Photo LfEyLfSh
*r1           -65.1966   103.1791              Photo LfEyLfSh
r2            -64.5895    77.2160              Photo LfEyLfSh
r3            -56.5392    80.2299              Photo LfEyLfSh
r4            -55.0858   115.3023              Photo LfEyLfSh
*r5           -44.4719   100.5526              Photo LfEyLfSh
r6            -43.7825    75.0169              Photo LfEyLfSh
r7            -32.1149    78.8540              Photo LfEyLfSh
r8            -31.6877   113.1492              Photo LfEyLfSh
c1            -80.6856   100.9327              Photo LfEyLfSh
c2            -81.4819    74.4441              Photo LfEyLfSh
*c3           -75.0687    80.1321              Photo LfEyLfSh
*c4           -72.8086   113.5465              Photo LfEyLfSh
*c5           -61.0782    99.1489              Photo LfEyLfSh
*c6           -61.1016    73.8980              Photo LfEyLfSh
c7            -50.4732    78.6031              Photo LfEyLfSh
c8            -50.5188   109.6709              Photo LfEyLfSh
l1              5.8712   104.0517              Photo LfEyLfSh
l2              5.1286    75.7192              Photo LfEyLfSh
l3             24.5773    77.4904              Photo LfEyLfSh
l4             26.0571   106.3056              Photo LfEyLfSh
l5             24.5327   102.0173              Photo LfEyLfSh
l6             24.0535    74.7473              Photo LfEyLfSh
l7             44.5187    75.3447              Photo LfEyLfSh
l8             43.4507   104.2003              Photo LfEyLfSh
********
RtEyLfSh     -838.200      1.000     1.000
Origin         35.1290     8.4642              Photo RtEyLfSh
Rib_Lf         36.1826    -1.2707              Photo RtEyLfSh
Rib_Rt        -12.8694    21.0015              Photo RtEyLfSh
SpineTop      -37.9129    19.6061              Photo RtEyLfSh
SpineBot      -42.6158     9.7926              Photo RtEyLfSh
spine_bb      -67.8802    16.8707              Photo RtEyLfSh
sternum        46.1639   -80.7238              Photo RtEyLfSh
*lf_shold     -28.3954   -90.2614              Photo RtEyLfSh
lneckT        -48.0064    51.6873              Photo RtEyLfSh
lneckB        -50.7060   -15.7700              Photo RtEyLfSh
*r1          -130.9705   104.1113              Photo RtEyLfSh
*r2          -130.3634    78.0729              Photo RtEyLfSh
*r3          -130.0745    82.1858              Photo RtEyLfSh
*r4          -128.2289   117.3177              Photo RtEyLfSh
*r5          -108.5759   101.5004              Photo RtEyLfSh
*r6          -107.9208    76.4045              Photo RtEyLfSh
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r7	-104.5107	80.4776		Photo RtEyLfSh
r8	-103.4005	114.9166		Photo RtEyLfSh
c1	-144.9755	102.1329		Photo RtEyLfSh
c2	-145.6104	75.3767		Photo RtEyLfSh
*c3	-146.6254	81.9221		Photo RtEyLfSh
*c4	-144.7454	115.1035		Photo RtEyLfSh
*c5	-124.1269	99.9733		Photo RtEyLfSh
*c6	-124.0307	74.8475		Photo RtEyLfSh
*c7	-120.7261	80.1389		Photo RtEyLfSh
*c8	-120.8195	111.1259		Photo RtEyLfSh
l1	-60.5933	105.0697		Photo RtEyLfSh
l2	-61.5468	76.7790		Photo RtEyLfSh
l3	-43.4213	78.3935		Photo RtEyLfSh
l4	-42.0398	107.1388		Photo RtEyLfSh
l5	-40.5516	102.7052		Photo RtEyLfSh
l6	-41.3556	75.4077		Photo RtEyLfSh
l7	-22.5213	76.1117		Photo RtEyLfSh
l8	-23.2699	104.6938		Photo RtEyLfSh
********				
LfEyRtSh	-838.200	1.000	1.000	
Origin	-86.9139	6.5021		Photo LfEyRtSh
Rib_Lf	-26.2886	9.9762		Photo LfEyRtSh
Rib_Rt	-80.8540	4.0678		Photo LfEyRtSh
SpineTop	-12.9312	16.8226		Photo LfEyRtSh
SpineBot	-8.8[illegible]9	7.9518		Photo LfEyRtSh
spine_bb	24.35[illegible]2	24.5835		Photo LfEyRtSh
sternum	-106.6885	-67.4695		Photo LfEyRtSh
*rt_shold	0.2868	-88.6234		Photo LfEyRtSh
rneckT	24.9890	52.5166		Photo LfEyRtSh
rneckB	25.7339	-15.3130		Photo LfEyRtSh
r1	3.1623	113.1687		Photo LfEyRtSh
r2	4.0824	81.5898		Photo LfEyRtSh
r3	24.2384	81.0082		Photo LfEyRtSh
r4	21.3020	109.3849		Photo LfEyRtSh
r5	-13.3797	110.5201		Photo LfEyRtSh
r6	-14.3051	79.7559		Photo LfEyRtSh
r7	4.4502	79.0529		Photo LfEyRtSh
r8	3.7172	108.2719		Photo LfEyRtSh
c1	91.7840	107.9168		Photo LfEyRtSh
c2	92.0813	83.0785		Photo LfEyRtSh
c3	109.8955	80.2257		Photo LfEyRtSh
c4	108.4676	105.6101		Photo LfEyRtSh
c5	71.8336	105.9312		Photo LfEyRtSh
c6	71.4438	80.9328		Photo LfEyRtSh
c7	89.8598	78.4445		Photo LfEyRtSh
c8	89.0715	103.7850		Photo LfEyRtSh
l1	77.6038	121.6977		Photo LfEyRtSh
l2	78.9127	90.3949		Photo LfEyRtSh
l3	97.4861	89.3339		Photo LfEyRtSh
l4	95.9944	119.0610		Photo LfEyRtSh
l5	57.6219	118.6686		Photo LfEyRtSh
l6	56.4894	88.7575		Photo LfEyRtSh
l7	76.4972	86.8266		Photo LfEyRtSh
l8	75.3420	116.3782		Photo LfEyRtSh
********				
RtEyRtSh	-838.200	1.000	1.000	
Origin	-142.4749	8.4053		Photo RtEyRtSh
Rib_Lf	-87.0137	7.6897		Photo RtEyRtSh
Rib_Rt	-136.8364	2.5626		Photo RtEyRtSh

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SpineTop     -74.6417    15.0848          Photo RtEyRtSh
SpineBot     -63.9205     7.1271          Photo RtEyRtSh
spine_bb     -26.3823    24.0121          Photo RtEyRtSh
sternum     -164.8196   -68.0076          Photo RtEyRtSh
*rt_shold    -38.0261   -88.0801          Photo RtEyRtSh
lneckT       174.8515    68.8762          Photo RtEyRtSh
lneckB       172.3995   -14.2002          Photo RtEyRtSh
rneckT       -14.3094    52.7858          Photo RtEyRtSh
rneckB       -13.5676   -15.1412          Photo RtEyRtSh
r1           -46.0271   111.9888          Photo RtEyRtSh
r2           -44.7371    80.9632          Photo RtEyRtSh
r3           -23.6062    79.9656          Photo RtEyRtSh
r4           -26.7760   108.6349          Photo RtEyRtSh
r5           -61.3325   109.3273          Photo RtEyRtSh
r6           -61.5246    78.1450          Photo RtEyRtSh
r7           -42.1077    77.8838          Photo RtEyRtSh
r8           -43.3173   107.3571          Photo RtEyRtSh
c1            43.2465   107.2244          Photo RtEyRtSh
c2            43.6043    82.0303          Photo RtEyRtSh
c3            62.6235    79.8974          Photo RtEyRtSh
c4            60.9998   105.4642          Photo RtEyRtSh
c5            24.1418   105.2303          Photo RtEyRtSh
c6            24.2777    80.3777          Photo RtEyRtSh
c7            43.1476    77.7396          Photo RtEyRtSh
c8            42.4845   102.9435          Photo RtEyRtSh
l1            23.6428   121.1788          Photo RtEyRtSh
l2            25.3629    90.4545          Photo RtEyRtSh
l3            44.9857    89.1972          Photo RtEyRtSh
l4            43.1961   118.5550          Photo RtEyRtSh
l5             4.9370   118.6117          Photo RtEyRtSh
l6             4.6803    88.3057          Photo RtEyRtSh
l7            25.4536    86.6072          Photo RtEyRtSh
l8            23.7276   115.3987          Photo RtEyRtSh
********
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Head Anthropometry Prep Printed Output

Naval BioDynamics Laboratory PREP Page 1
Head Anthropometry for HRV # 00253 Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #1

Fid	X	Y
1	18.113	-12.126
2	18.105	12.126
3	-18.120	12.131
4	-18.105	-12.126

Calibrated Focal Length = -55.003 mm. Xoff= -0.005 mm. Yoff= -0.022 mm.

Lens Distortion

Radial Parameters
K0=+0.1924312OD-03 K1=-0.2839673OD-05 K2=+0.1940416OD-07
K3=-0.4715753OD-10

Naval BioDynamics Laboratory PREP Page 2
Head Anthropometry for HRV # 00253 Date: 08/05/92

Fiducial Measurements of Frame #1

ID	Measured X	Y
1	14.468	4.869
2	14.617	11.777
3	4.328	11.964
4	4.146	5.124

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.047	0.071

Transformation Parameters Are:

3.528078	-0.086591	-32.3087	0.000957	-0.000547
0.075706	3.542118	-30.6039		

Naval BioDynamics Laboratory PREP — Page 3
Head Anthropometry for HRV # 00253 — Date: 08/05/92

Plate Coordinates for Frame 1

ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Control:				
a	5.272	10.869	-14.656	8.323
j	8.747	11.635	-2.446	11.271
k	8.391	8.316	-3.408	-0.489
rtc1	7.900	5.947	-4.926	-8.881
rtc2	7.229	5.924	-7.286	-9.018
rtc3	7.150	6.242	-7.593	-7.904
rtc4	7.808	6.262	-5.278	-7.779
rtc5	7.853	5.354	-5.038	-10.973
rtc6	7.195	5.332	-7.352	-11.107
Targets:				
ear1-r	10.607	7.388	4.452	-3.588
ear2-r	10.491	7.619	4.027	-2.784
ear3-r	10.382	7.843	3.626	-2.004
ear4-r	10.263	8.067	3.190	-1.224
mrc1	11.455	7.861	7.381	-1.858
mrc2	11.221	7.963	6.554	-1.517
mrc3	11.150	8.075	6.296	-1.128
mrc4	11.344	7.971	6.984	-1.479
mrc5	11.314	7.632	6.907	-2.674
mrc6	11.096	7.739	6.135	-2.315
mcc1	11.668	8.567	8.068	0.643
mcc2	11.457	8.685	7.321	1.043
mcc3	11.367	8.774	6.998	1.349
mcc4	11.571	8.686	7.719	1.055
mcc5	11.533	8.351	7.614	-0.128

Naval BioDynamics Laboratory PREP Page 4
Head Anthropometry for HRV # 00253 Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #2

Fid	X	Y
1	18.116	-12.132
2	18.119	12.136
3	-18.126	12.139
4	-18.112	-12.132

Calibrated Focal Length = -55.003 mm. Xoff= +0.027 mm. Yoff= +0.088 mm.

Lens Distortion

Radial Parameters
K0=+0.64679230D-03 K1=-0.13013980D-04 K2=+0.76994240D-07
K3=-0.14139510D-09

Naval BioDynamics Laboratory PREP — Page 5
Head Anthropometry for HRV # 00253 — Date: 08/05/92

Fiducial Measurements of Frame #2

ID	Measured X	Y
1	14.584	4.916
2	14.637	11.765
3	4.488	11.838
4	4.260	5.003

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.193	0.076

Transformation Parameters Are:

3.470361	-0.072014	-32.3217	0.000165	-0.002513
0.026816	3.477392	-29.4981		

Plate Coordinates for Frame 2

	ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Control:					
	a	6.106	10.643	-12.239	7.790
	b	6.999	10.754	-9.067	8.212
	c	6.227	7.958	-11.529	-1.778
	d	7.053	8.318	-8.642	-0.480
	j	13.249	10.696	13.186	8.167
	rtc1	6.568	6.787	-10.206	-5.901
	rtc2	6.148	6.883	-11.698	-5.575
	rtc3	6.472	7.050	-10.571	-4.978
	rtc4	6.878	6.946	-9.128	-5.333
	rtc5	6.598	6.307	-10.053	-7.588
	rtc6	6.171	6.402	-11.568	-7.266
	rtc8	6.890	6.465	-9.039	-7.024
	cen1	8.116	9.802	-5.006	4.[illegible]2
	cen3	8.045	9.912	-5.268	5.[illegible]4
	cen4	8.359	9.860	-4.147	5.046
	cen5	8.124	[illegible]388	-4.942	3.355
	cen8	8.349	[illegible]461	-4.150	3.622
	lfc5	8.813	[illegible]97	-2.513	4.120
	lfc6	8.508	[illegible]650	-3.600	4.300
Targets:					
	ron	10.424	8.389	3.288	-0.136

ear1-r	9.135	7.384	-1.199	-3.728
ear2-r	9.211	7.569	-0.945	-3.073
ear3-r	9.293	7.762	-0.669	-2.388
ear4-r	9.366	7.952	-0.426	-1.714
mrc1	10.887	7.458	4.982	-3.417
mrc2	10.661	7.592	4.176	-2.950
mrc3	10.780	7.682	4.591	-2.629
mrc5	10.778	7.251	4.610	-4.150
mrc6	10.570	7.411	3.866	-3.592
mrc8	10.885	7.314	4.984	-3.925
mcc1	11.335	8.064	6.529	-1.262
mcc2	11.119	8.197	5.758	-0.797
mcc3	11.224	8.297	6.124	-0.440
mcc4	11.422	8.149	6.832	-0.959
mcc5	11.228	7.874	6.162	-1.938

Naval BioDynamics Laboratory PREP Page 7
Head Anthropometry for HRV # 00253 Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #3

Fid	X	Y
1	18.108	-12.122
2	18.110	12.124
3	-18.117	12.128
4	-18.107	-12.122

Calibrated Focal Length = -55.005 mm. Xoff= +0.037 mm. Yoff= +0.088 mm.

Lens Distortion

Radial Parameters
K0=+0.59205760D-03 K1=-0.11202800D-04 K2=+0.68771330D-07
K3=-0.13585810D-09

Naval BioDynamics Laboratory PREP Page 8
Head Anthropometry for HRV # 00253 Date: 08/05/92

Fiducial Measurements of Frame #3

ID	Measured X	Y
1	14.050	5.175
2	14.005	12.034
3	3.751	12.032
4	3.735	5.174

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y

1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.062	0.033

Transformation Parameters Are:

3.495096	0.006482	-31.1107	0.000017	-0.000903
-0.000593	3.508391	-30.2153		

Naval BioDynamics Laboratory PREP — Page 9
Head Anthropometry for HRV # 00253 — Date: 08/05/92

Plate Coordinates for Frame 3

ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Control:				
a	8.308	10.640	-2.061	7.090
b	9.649	10.596	2.671	6.933
c	8.229	7.972	-2.352	-2.356
g	4.971	10.697	-13.836	7.294
h	10.930	10.803	7.193	7.666
rtc1	6.891	6.921	-7.062	-6.063
rtc2	6.810	7.107	-7.347	-5.407
rtc3	7.280	7.147	-5.694	-5.267
rtc4	7.388	6.963	-5.314	-5.915
rtc5	6.891	6.452	-7.061	-7.715
rtc6	6.774	6.624	-7.473	-7.109
rtc8	7.379	6.465	-5.346	-7.670
cen1	10.718	9.405	6.429	2.711
lfc1	12.009	9.436	10.978	2.819
lfc2	11.820	9.541	10.313	3.191
lfc3	12.195	9.550	11.635	3.223
lfc4	12.418	9.438	12.419	2.826
lfc5	11.974	9.000	10.847	1.276
lfc6	11.779	9.085	10.162	1.577
lfc8	12.378	9.000	12.270	1.276
Targets:				
ron	10.367	7.535	5.171	-3.900
lon	11.091	7.593	7.718	-3.695
ear1-r	8.442	6.876	-1.607	-6.223
ear2-r	8.680	7.032	-0.769	-5.674
ear3-r	8.922	7.201	0.083	-5.078
ear4-r	9.159	7.365	0.918	-4.500
ear1-l	12.246	7.044	11.772	-5.632
ear2-l	12.002	7.183	10.916	-5.141
ear3-l	11.758	7.308	10.060	-4.700
ear4-l	11.520	7.440	9.225	-4.235
mrc1	10.385	6.342	5.219	-8.104
mrc2	10.280	6.565	4.853	-7.319
mrc5	10.322	6.138	4.996	-8.822
mrc6	10.201	6.353	4.573	-8.065

mrc8	10.600	6.158	5.973	-8.752
mcc1	11.018	6.896	7.452	-6.153
mcc2	10.888	7.138	6.998	-5.300
mcc3	11.182	7.172	8.032	-5.180
mcc4	11.293	6.925	8.419	-6.051
mcc5	10.956	6.684	7.231	-6.900
mcc6	10.823	6.922	6.766	-6.061
mcc8	11.223	6.721	8.170	-6.769
mlc3	11.456	6.726	8.989	-6.752
mlc4	11.567	6.499	9.376	-7.551
mlc5	11.234	6.242	8.202	-8.456
mlc8	11.500	6.289	9.137	-8.291

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Head Anthropometry for HRV # 00253 Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #4

Fid	X	Y
1	18.102	-12.127
2	18.110	12.118
3	-18.109	12.132
4	-18.124	-12.127

Calibrated Focal Length = -55.004 mm. Xoff= -0.056 mm. Yoff= +0.132 mm.

Lens Distortion

Radial Parameters
K0=+0.72422290D-03 K1=-0.13957730D-04 K2=+0.81529700D-07
K3=-0.14888030D-09

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Head Anthropometry for HRV # 00253 Date: 08/05/92

Fiducial Measurements of Frame #4

ID	Measured X	Y
1	14.080	5.698
2	14.062	12.516
3	3.849	12.604
4	3.790	5.714

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000

4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.069	0.062

Transformation Parameters Are:

3.469922	-0.008782	-31.0518	-0.000952	-0.001033
0.017154	3.474843	-31.9335		

Plate Coordinates for Frame 4

	ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Control:					
	a	7.756	11.858	-4.272	9.460
	b	9.236	11.789	0.968	9.255
	d	9.252	9.104	1.047	-0.275
	f	11.288	6.956	8.258	-7.839
	g	6.416	11.952	-9.005	9.758
	h	12.793	12.006	13.622	10.124
	rtc1	5.687	8.169	-11.494	-3.630
	rtc2	5.827	8.368	-11.007	-2.928
	rtc3	6.311	8.362	-9.308	-2.942
	rtc4	6.205	8.169	-9.676	-3.623
	rtc5	5.739	7.680	-11.301	-5.350
	rtc8	6.238	7.679	-9.551	-5.347
	cen1	10.165	10.474	4.272	4.603
	cen2	10.180	10.605	4.324	5.068
	cen3	10.679	10.590	6.095	5.026
	cen4	10.675	10.474	6.081	4.613
	cen5	10.149	9.978	4.218	2.841
	cen8	10.660	9.961	6.030	2.791
	lfc1	11.720	10.457	9.793	4.575
	lfc2	11.685	10.567	9.669	4.966
	lfc3	12.179	10.572	11.427	4.995
	lfc4	12.245	10.443	11.662	4.537
	lfc5	11.701	9.959	9.725	2.804
	lfc8	12.218	9.945	11.564	2.765
Targets:					
	ron	7.549	8.508	-4.958	-2.409
	lon	8.415	8.504	-1.905	-2.411
	ear1-r	5.942	7.989	-10.595	-4.260
	ear2-r	6.214	8.143	-9.644	-3.715
	ear3-r	6.479	8.278	-8.716	-3.235
	ear4-r	6.754	8.424	-7.753	-2.717
	ear1-l	10.218	7.780	4.471	-4.943
	ear2-l	9.953	7.954	3.533	-4.332
	ear3-l	9.693	8.117	2.613	-3.760
	ear4-l	9.434	8.291	1.696	-3.148
	mrc1	7.225	7.253	-6.078	-6.835
	mrc2	7.252	7.500	-5.987	-5.966
	mrc5	7.260	7.044	-5.951	-7.570
	mrc8	7.576	7.038	-4.841	-7.588
	mcc1	7.645	7.781	-4.609	-4.972

mcc2	7.658	8.033	-4.567	-4.084
mcc3	8.003	8.046	-3.352	-4.033
mcc4	7.985	7.789	-3.412	-4.940
mcc5	7.687	7.561	-4.458	-5.746
mcc7	8.042	7.821	-3.212	-4.826
mcc8	8.027	7.568	-3.261	-5.718
mlc1	8.281	7.251	-2.363	-6.832
mlc3	8.621	7.531	-1.168	-5.842
mlc4	8.610	7.274	-1.204	-6.747
mlc5	8.314	7.056	-2.244	-7.518
mlc7	8.662	7.309	-1.021	-6.623
mlc8	8.636	7.066	-1.110	-7.479

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Head Anthropometry for HRV # 00253 Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #5

Fid	X	Y
1	18.130	-12.125
2	18.123	12.136
3	-18.118	12.117
4	-18.106	-12.125

Calibrated Focal Length = -55.002 mm. Xoff= +0.013 mm. Yoff= +0.122 mm.

Lens Distortion

Radial Parameters
K0=+0.31260690D-03 K1=-0.76500290D-05 K2=+0.56783210D-07
K3=-0.12129480D-09

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Head Anthropometry for HRV # 00253 Date: 08/05/92

Fiducial Measurements of Frame #5

ID	Measured X	Y
1	14.162	5.077
2	14.136	11.949
3	3.842	11.871
4	3.869	5.051

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000

2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.037	0.067

Transformation Parameters Are:

3.541999	0.012342	-31.9213	0.000664	0.000018
-0.017068	3.564324	-30.0959		

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Head Anthropometry for HRV # 00253 — Date: 08/05/92

Plate Coordinates for Frame 5

	ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Control:					
	b	10.896	11.654	6.753	11.052
	c	9.645	9.043	2.325	1.837
	d	10.777	8.689	6.300	0.564
	f	10.960	5.820	6.907	-9.591
	cen1	11.029	10.034	7.200	5.318
	cen2	11.402	10.146	8.511	5.706
	cen3	11.867	10.024	10.141	5.265
	cen4	11.482	9.913	8.789	4.880
	cen5	10.991	9.488	7.060	3.387
	cen8	11.448	9.340	8.662	2.854
	lfc1	12.479	9.641	12.282	3.899
	lfc2	12.852	9.773	13.591	4.358
	lfc3	13.375	9.641	15.420	3.881
	lfc4	13.006	9.508	14.127	3.419
	lfc5	12.426	9.059	12.089	1.843
	lfc7	13.339	9.041	15.287	1.763
	lfc8	12.949	8.900	13.920	1.272
Targets:					
	lon	6.377	8.628	-9.200	0.424
	ear1-r	5.552	8.666	-12.116	0.573
	ear2-r	5.740	8.731	-11.450	0.801
	ear1-l	8.036	7.346	-3.362	-4.150
	ear2-l	7.932	7.599	-3.726	-3.252
	ear3-l	7.817	7.844	-4.128	-2.381
	ear4-l	7.704	8.090	-4.524	-1.542
	mcc1	5.056	8.213	-13.877	-1.027
	mcc2	5.284	8.425	-13.067	-0.278
	mcc3	5.480	8.360	-12.375	-0.512
	mcc4	5.246	8.143	-13.205	-1.279
	mcc5	5.205	7.986	-13.353	-1.836
	mcc7	5.624	8.132	-11.868	-1.324
	mcc8	5.401	7.905	-12.660	-2.127
	mlc1	5.729	7.522	-11.504	-3.492
	mlc2	5.951	7.737	-10.717	-2.732
	mlc3	6.141	7.652	-10.046	-3.036
	mlc4	5.915	7.441	-10.848	-3.782

mlc5	5.878	7.290	-10.980	-4.317
mlc7	6.295	7.441	-9.505	-3.787
mlc8	6.065	7.232	-10.320	-4.526

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Head Anthropometry for HRV # 00253 Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #6

Fid	X	Y
1	18.105	-12.122
2	18.111	12.127
3	-18.134	12.141
4	-18.105	-12.122

Calibrated Focal Length = -55.005 mm. Xoff= +0.045 mm. Yoff= +0.036 mm.

Lens Distortion

Radial Parameters
K0=+0.7208347OD-03 K1=-0.1328443OD-04 K2=+0.7942249OD-07
K3=-0.1541224OD-09

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Head Anthropometry for HRV # 00253 Date: 08/05/92

Fiducial Measurements of Frame #6

ID	Measured X	Y
1	13.479	5.731
2	13.487	12.568
3	3.246	12.600
4	3.209	5.750

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.041	0.031

Transformation Parameters Are:

3.510959	-0.013339	-29.2288	-0.000120	-0.000549
0.008223	3.523136	-32.3652		

Plate Coordinates for Frame 6

	ID	Measured X	Measured Y	Adjusted X	Adjusted Y
Control:					
	b	13.038	11.118	16.473	6.927
	rtc1	9.827	8.701	5.145	-1.676
	rtc2	10.437	8.651	7.300	-1.848
	rtc3	10.409	8.388	7.204	-2.780
	rtc4	9.790	8.438	5.017	-2.608
	rtc7	10.374	7.818	7.085	-4.799
	rtc8	9.805	7.870	5.076	-4.620
	cen1	11.320	8.752	10.418	-1.483
	cen2	12.234	8.677	13.649	-1.741
	cen3	12.268	8.272	13.772	-3.176
	cen4	11.303	8.351	10.361	-2.904
	cen8	11.230	7.524	10.110	-5.833
	lfc1	11.232	7.462	10.117	-6.052
	lfc2	12.321	7.348	13.964	-6.447
	lfc3	12.344	6.787	14.047	-8.431
	lfc4	11.189	6.901	9.970	-8.037
	lfc7	12.218	5.845	13.602	-11.757
	lfc8	11.105	5.958	9.681	-11.371
Targets:					
	ear1-l	5.411	7.091	-10.418	-7.408
	ear2-l	5.617	7.410	-9.697	-6.278
	ear3-l	5.844	7.720	-8.903	-5.180
	ear4-l	6.036	8.018	-8.231	-4.124
	mcc1	4.382	9.228	-14.091	0.147
	mcc2	4.661	9.350	-13.108	0.582
	mcc3	4.576	9.210	-13.406	0.085
	mcc4	4.255	9.093	-14.536	-0.332
	mcc8	4.422	8.786	-13.940	-1.418
	mlc1	4.577	8.270	-13.382	-3.244
	mlc3	4.767	8.247	-12.712	-3.323
	mlc4	4.464	8.125	-13.778	-3.758
	mlc7	4.943	7.941	-12.085	-4.405
	mlc8	4.630	7.807	-13.186	-4.882

Head Anthropometry Image Data File

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       a     -14.6561     8.3229                 Photo        #1
       j      -2.4462    11.2708                 Photo        #1
       k      -3.4083    -0.4887                 Photo        #1
    rtc1      -4.9258    -8.8809                 Photo        #1
    rtc2      -7.2857    -9.0182                 Photo        #1
    rtc3      -7.5927    -7.9039                 Photo        #1
    rtc4      -5.2776    -7.7789                 Photo        #1
    rtc5      -5.0384   -10.9729                 Photo        #1
    rtc6      -7.3519   -11.1068                 Photo        #1
  ear1-r       4.4523    -3.5880                 Photo        #1
  ear2-r       4.0266    -2.7841                 Photo        #1
  ear3-r       3.6258    -2.0039                 Photo        #1
  ear4-r       3.1898    -1.2241                 Photo        #1
    mrc1       7.3812    -1.8577                 Photo        #1
    mrc2       6.5542    -1.5168                 Photo        #1
    mrc3       6.2965    -1.1281                 Photo        #1
    mrc4       6.9839    -1.4792                 Photo        #1
    mrc5       6.9068    -2.6742                 Photo        #1
    mrc6       6.1352    -2.3147                 Photo        #1
    mcc1       8.0685     0.6428                 Photo        #1
    mcc2       7.3207     1.0425                 Photo        #1
    mcc3       6.9984     1.3493                 Photo        #1
    mcc4       7.7194     1.0545                 Photo        #1
    mcc5       7.6139    -0.1276                 Photo        #1
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      #2      -55.003      0.055      0.055  #2-736
*      a     -12.2394     7.7903                 Photo        #2
       b      -9.0674     8.2118                 Photo        #2
       c     -11.5294    -1.7780                 Photo        #2
       d      -8.6416    -0.4798                 Photo        #2
*      j      13.1862     8.1672                 Photo        #2
    rtc1     -10.2061    -5.9014                 Photo        #2
    rtc2     -11.6981    -5.5755                 Photo        #2
    rtc3     -10.5711    -4.9781                 Photo        #2
    rtc4      -9.1278    -5.3331                 Photo        #2
*   rtc5     -10.0529    -7.5876                 Photo        #2
    rtc6     -11.5678    -7.2664                 Photo        #2
    rtc8      -9.0391    -7.0244                 Photo        #2
    cen1      -5.0059     4.8324                 Photo        #2
    cen3      -5.2677     5.2235                 Photo        #2
    cen4      -4.1473     5.0464                 Photo        #2
    cen5      -4.9422     3.3550                 Photo        #2
    cen8      -4.1495     3.6216                 Photo        #2
    lfc5      -2.5127     4.1197                 Photo        #2
    lfc6      -3.6005     4.3004                 Photo        #2
     ron       3.2881    -0.1357                 Photo        #2
  ear1-r      -1.1992    -3.7278                 Photo        #2
  ear2-r      -0.9448    -3.0725                 Photo        #2
  ear3-r      -0.6695    -2.3880                 Photo        #2
  ear4-r      -0.4255    -1.7137                 Photo        #2
    mrc1       4.9823    -3.4171                 Photo        #2
    mrc2       4.1764    -2.9505                 Photo        #2
    mrc3       4.5911    -2.6291                 Photo        #2
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mrc5	4.6101	-4.1503		Photo	#2
mrc6	3.8664	-3.5920		Photo	#2
mrc8	4.9838	-3.9251		Photo	#2
mcc1	6.5291	-1.2623		Photo	#2
mcc2	5.7582	-0.7973		Photo	#2
mcc3	6.1236	-0.4400		Photo	#2
mcc4	6.8317	-0.9589		Photo	#2
mcc5	6.1619	-1.9376		Photo	#2
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#3	-55.005	0.055	0.055	#3-674	
a	-2.0609	7.0902		Photo	#3
b	2.6711	6.9331		Photo	#3
c	-2.3523	-2.3564		Photo	#3
* g	-13.8361	7.2936		Photo	#3
* h	7.1930	7.6657		Photo	#3
rtc1	-7.0615	-6.0627		Photo	#3
rtc2	-7.3465	-5.4070		Photo	#3
rtc3	-5.6936	-5.2666		Photo	#3
rtc4	-5.3140	-5.9154		Photo	#3
rtc5	-7.0613	-7.7149		Photo	#3
rtc6	-7.4727	-7.1090		Photo	#3
rtc8	-5.3460	-7.6696		Photo	#3
cen1	6.4287	2.7106		Photo	#3
lfc1	10.9777	2.8190		Photo	#3
lfc2	10.3134	3.1909		Photo	#3
lfc3	11.6352	3.2225		Photo	#3
lfc4	12.4192	2.8258		Photo	#3
lfc5	10.8473	1.2760		Photo	#3
lfc6	10.1618	1.5768		Photo	#3
lfc8	12.2705	1.2757		Photo	#3
ron	5.1706	-3.8999		Photo	#3
lon	7.7181	-3.6950		Photo	#3
ear1-r	-1.6074	-6.2233		Photo	#3
ear2-r	-0.7694	-5.6737		Photo	#3
ear3-r	0.0830	-5.0781		Photo	#3
ear4-r	0.9182	-4.4998		Photo	#3
ear1-l	11.7717	-5.6316		Photo	#3
ear2-l	10.9159	-5.1414		Photo	#3
ear3-l	10.0597	-4.7005		Photo	#3
ear4-l	9.2247	-4.2348		Photo	#3
mrc1	5.2194	-8.1040		Photo	#3
mrc2	4.8530	-7.3189		Photo	#3
mrc5	4.9956	-8.8219		Photo	#3
mrc6	4.5729	-8.0653		Photo	#3
mrc8	5.9727	-8.7516		Photo	#3
mcc1	7.4515	-6.1528		Photo	#3
mcc2	6.9978	-5.2999		Photo	#3
mcc3	8.0320	-5.1799		Photo	#3
mcc4	8.4187	-6.0506		Photo	#3
mcc5	7.2306	-6.8997		Photo	#3
mcc6	6.7663	-6.0612		Photo	#3
mcc8	8.1697	-6.7694		Photo	#3
mlc3	8.9888	-6.7518		Photo	#3
mlc4	9.3756	-7.5514		Photo	#3
mlc5	9.2016	-8.4561		Photo	#3
mlc8	8.1370	-8.2908		Photo	#3
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#4	-55.004	0.055	0.055	#4-623	
a	-4.2721	9.4603		Photo	#4

	b	0.9680	9.2549		Photo	#4
	d	1.0467	-0.2746		Photo	#4
	f	8.2583	-7.8387		Photo	#4
*	g	-9.0048	9.7582		Photo	#4
*	h	13.6216	10.1241		Photo	#4
	rtc1	-11.4936	-3.6303		Photo	#4
	rtc2	-11.0066	-2.9276		Photo	#4
	rtc3	-9.3077	-2.9418		Photo	#4
	rtc4	-9.6761	-3.6231		Photo	#4
	rtc5	-11.3011	-5.3500		Photo	#4
	rtc8	-9.5508	-5.3473		Photo	#4
	cen1	4.2716	4.6027		Photo	#4
	cen2	4.3240	5.0684		Photo	#4
	cen3	6.0947	5.0258		Photo	#4
	cen4	6.0809	4.6134		Photo	#4
	cen5	4.2176	2.8411		Photo	#4
	cen8	6.0296	2.7907		Photo	#4
	lfc1	9.7933	4.5752		Photo	#4
	lfc2	9.6689	4.9658		Photo	#4
	lfc3	11.4271	4.9947		Photo	#4
	lfc4	11.6617	4.5369		Photo	#4
	lfc5	9.7253	2.8040		Photo	#4
	lfc8	11.5639	2.7647		Photo	#4
	ron	-4.9580	-2.4093		Photo	#4
	lon	-1.9052	-2.4108		Photo	#4
	ear1-r	-10.5954	-4.2603		Photo	#4
	ear2-r	-9.6440	-3.7145		Photo	#4
	ear3-r	-8.7163	-3.2354		Photo	#4
	ear4-r	-7.7529	-2.7170		Photo	#4
	ear1-l	4.4710	-4.9426		Photo	#4
	ear2-l	3.5332	-4.3317		Photo	#4
	ear3-l	2.6131	-3.7595		Photo	#4
	ear4-l	1.6963	-3.1484		Photo	#4
	mrc1	-6.0777	-6.8351		Photo	#4
	mrc2	-5.9869	-5.9658		Photo	#4
	mrc5	-5.9513	-7.5698		Photo	#4
	mrc8	-4.8406	-7.5879		Photo	#4
	mcc1	-4.6091	-4.9719		Photo	#4
	mcc2	-4.5671	-4.0836		Photo	#4
	mcc3	-3.3523	-4.0334		Photo	#4
	mcc4	-3.4122	-4.9398		Photo	#4
	mcc5	-4.4581	-5.7464		Photo	#4
	mcc7	-3.2119	-4.8263		Photo	#4
	mcc8	-3.2613	-5.7180		Photo	#4
	mlc1	-2.3627	-6.8317		Photo	#4
	mlc3	-1.1677	-5.8417		Photo	#4
	mlc4	-1.2037	-6.7473		Photo	#4
	mlc5	-2.2441	-7.5177		Photo	#4
	mlc7	-1.0208	-6.6234		Photo	#4
	mlc8	-1.1099	-7.4794		Photo	#4
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	#5	-55.002	0.055	0.055	#5-591	
	b	6.7533	11.0523		Photo	#5
	c	2.3252	1.8373		Photo	#5
	d	6.2996	0.5637		Photo	#5
	f	6.9070	-9.5909		Photo	#5
	cen1	7.2002	5.3176		Photo	#5
	cen2	8.5108	5.7060		Photo	#5
	cen3	10.1407	5.2651		Photo	#5

cen4	8.7887	4.8803		Photo	#5
cen5	7.0604	3.3868		Photo	#5
cen8	8.6625	2.8544		Photo	#5
lfc1	12.2821	3.8990		Photo	#5
lfc2	13.5909	4.3583		Photo	#5
lfc3	15.4201	3.8815		Photo	#5
lfc4	14.1271	3.4189		Photo	#5
lfc5	12.0891	1.8428		Photo	#5
lfc7	15.2873	1.7627		Photo	#5
lfc8	13.9201	1.2715		Photo	#5
lon	-9.2001	0.4239		Photo	#5
ear1-r	-12.1160	0.5732		Photo	#5
ear2-r	-11.4502	0.8006		Photo	#5
ear1-l	-3.3622	-4.1501		Photo	#5
ear2-l	-3.7259	-3.2516		Photo	#5
ear3-l	-4.1284	-2.3811		Photo	#5
ear4-l	-4.5240	-1.5424		Photo	#5
mcc1	-13.8771	-1.0273		Photo	#5
mcc2	-13.0674	-0.2781		Photo	#5
mcc3	-12.3746	-0.5122		Photo	#5
mcc4	-13.2054	-1.2790		Photo	#5
mcc5	-13.3525	-1.8360		Photo	#5
mcc7	-11.8680	-1.3241		Photo	#5
mcc8	-12.6599	-2.1267		Photo	#5
mlc1	-11.5044	-3.4916		Photo	#5
mlc2	-10.7166	-2.7316		Photo	#5
mlc3	-10.0461	-3.0362		Photo	#5
mlc4	-10.8477	-3.7819		Photo	#5
mlc5	-10.9804	-4.3174		Photo	#5
mlc7	-9.5046	-3.7873		Photo	#5
mlc8	-10.3200	-4.5259		Photo	#5
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#6	-55.005	0.055	0.055	#6-806	
* b	16.4732	6.9266		Photo	#6
rtc1	5.1453	-1.6760		Photo	#6
rtc2	7.3002	-1.8480		Photo	#6
rtc3	7.2036	-2.7801		Photo	#6
rtc4	5.0172	-2.6084		Photo	#6
rtc7	7.0849	-4.7990		Photo	#6
rtc8	5.0756	-4.6199		Photo	#6
* cen1	10.4182	-1.4826		Photo	#6
cen2	13.6490	-1.7410		Photo	#6
cen3	13.7715	-3.1759		Photo	#6
cen4	10.3611	-2.9036		Photo	#6
cen8	10.1095	-5.8326		Photo	#6
* lfc1	10.1170	-6.0520		Photo	#6
lfc2	13.9637	-6.4472		Photo	#6
* lfc3	14.0469	-8.4311		Photo	#6
lfc4	9.9697	-8.0371		Photo	#6
* lfc7	13.6024	-11.7572		Photo	#6
lfc8	9.6807	-11.3713		Photo	#6
ear1-l	-10.4178	-7.4077		Photo	#6
ear2-l	-9.6974	-6.2782		Photo	#6
ear3-l	-8.9027	-5.1801		Photo	#6
ear4-l	-8.2312	-4.1243		Photo	#6
mcc1	-14.0906	0.1473		Photo	#6
mcc2	-13.1084	0.5819		Photo	#6
mcc3	-13.4055	0.0852		Photo	#6
mcc4	-14.5359	-0.3320		Photo	#6

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    mcc8     -13.9401    -1.4180          Photo       #6
    mlc1     -13.3825    -3.2436          Photo       #6
    mlc3     -12.7118    -3.3235          Photo       #6
    mlc4     -13.7781    -3.7577          Photo       #6
    mlc7     -12.0847    -4.4050          Photo       #6
    mlc8     -13.1860    -4.8815          Photo       #6
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Initial Conditions Image Data File

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      #1     -55.003      0.025     0.025  #1-580
       a      4.0733    -5.9268                Photo        #1
       b      3.9411    -7.5439                Photo        #1
       c      9.0001    -9.5576                Photo        #1
    rtc1     -3.6518    -6.6810                Photo        #1
    rtc2     -5.2639    -7.0111                Photo        #1
    rtc3     -5.7427    -6.0392                Photo        #1
    rtc4     -4.0975    -5.8006                Photo        #1
    rtc5     -3.6487    -8.0633                Photo        #1
    rtc6     -5.2854    -8.3587                Photo        #1
*   cen1     -7.9262     4.3394                Photo        #1
    cen2     -9.1381     4.2633                Photo        #1
*   cen3     -9.4991     4.7138                Photo        #1
*   cen5     -7.8691     3.1781                Photo        #1
    cen6     -9.1218     3.0239                Photo        #1
*   cen7     -8.9064     5.6385                Photo        #1
*   lfc1    -10.4299     5.9394                Photo        #1
*   lfc2     -9.2076     6.0824                Photo        #1
*   lfc4    -10.0573     4.3687                Photo        #1
*   lfc6    -10.0467     4.3687                Photo        #1
    lfc7    -10.3618     4.7877                Photo        #1
    m_r1      2.9145     2.1257                Photo        #1
    m_r4      2.6727     2.4417                Photo        #1
    m_t1      3.4948     4.3627                Photo        #1
    m_t4      3.2826     4.5451                Photo        #1
    m_b1      3.8175     3.0954                Photo        #1
    m_b4      3.5655     3.3903                Photo        #1
  mtar01      2.5248     1.9018                Photo        #1
  mtar03      3.1365     4.1496                Photo        #1
  mtar06      2.5579     2.3742                Photo        #1
  mtar07      3.1597     4.5657                Photo        #1
  mtar11      3.4749     3.3476                Photo        #1
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      #2     -55.003      0.025     0.025  #2-736
       a     -2.0814    -5.0775                Photo        #2
       b     -1.9430    -6.7281                Photo        #2
       c      6.1033   -11.7813                Photo        #2
    rtc1    -10.1376    -2.8134                Photo        #2
    rtc2    -11.4042    -2.6223                Photo        #2
    rtc3    -10.6560    -1.7977                Photo        #2
    rtc4     -9.3077    -2.1061                Photo        #2
    rtc5     -9.9028    -4.1039                Photo        #2
    rtc6    -11.2055    -3.8221                Photo        #2
    rtc8     -9.1322    -3.3717                Photo        #2
    m_r1      3.4502     2.3454                Photo        #2
    m_r4      3.6971     2.6581                Photo        #2
    m_t1      5.5357     4.3027                Photo        #2
    m_t4      5.7714     4.5703                Photo        #2
    m_b1      5.9624     2.9070                Photo        #2
    m_b4      6.1916     3.1990                Photo        #2
  mtar01      3.0404     2.2183                Photo        #2
  mtar03      5.1160     4.2004                Photo        #2
  mtar06      3.3248     2.6526                Photo        #2
  mtar07      5.3872     4.6529                Photo        #2
  mtar09      5.5177     4.1245                Photo        #2
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mtar11	5.7814	3.1909		Photo	#2
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#3	-55.005	0.025	0.025	#3-674	
a	-11.1395	-3.1387		Photo	#3
b	-10.9820	-4.7801		Photo	#3
d	6.4082	-0.5924		Photo	#3
e	6.2630	-1.9408		Photo	#3
f	-6.8496	11.5518		Photo	#3
rtc1	-14.4433	1.1240		Photo	#3
rtc2	-14.8350	1.6272		Photo	#3
rtc3	-13.5483	1.9610		Photo	#3
rtc4	-13.1546	1.3412		Photo	#3
rtc5	-14.2932	-0.0966		Photo	#3
rtc6	-14.6648	0.3177		Photo	#3
rtc8	-13.0006	0.1735		Photo	#3
cen1	2.4712	5.4102		Photo	#3
cen2	1.8198	5.8215		Photo	#3
cen3	2.8532	6.0024		Photo	#3
cen4	3.5179	5.5591		Photo	#3
cen5	2.3619	4.2667		Photo	#3
cen6	1.7245	4.6636		Photo	#3
cen8	3.4020	4.4511		Photo	#3
lfc1	5.5028	5.9217		Photo	#3
lfc2	4.8271	6.3123		Photo	#3
lfc3	5.7899	6.5081		Photo	#3
lfc4	6.4828	6.1138		Photo	#3
lfc5	5.4117	4.8453		Photo	#3
lfc6	4.7320	5.1934		Photo	#3
lfc8	6.3835	4.9739		Photo	#3
m_r1	-2.3092	1.3017		Photo	#3
m_r4	-1.6742	1.4210		Photo	#3
m_t1	0.2279	2.5063		Photo	#3
m_t4	0.8300	2.5517		Photo	#3
m_b1	0.3891	0.8726		Photo	#3
m_b4	1.0244	1.0201		Photo	#3
m_l1	1.2089	2.0383		Photo	#3
m_l4	1.8647	2.1501		Photo	#3
mtar01	-2.5338	1.3328		Photo	#3
mtar03	-0.0295	2.4672		Photo	#3
mtar06	-2.1599	1.6390		Photo	#3
mtar07	0.4083	2.8008		Photo	#3
mtar08	1.4039	2.3643		Photo	#3
mtar09	0.4882	2.2840		Photo	#3
mtar11	0.5680	1.2977		Photo	#3
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#4	-55.004	0.025	0.025	#4-623	
a	-10.8802	0.1685		Photo	#4
b	-10.7169	-1.3150		Photo	#4
c	-12.2148	-9.4314		Photo	#4
d	7.0628	-4.9962		Photo	#4
e	6.9465	-6.4794		Photo	#4
f	15.8636	9.4537		Photo	#4
rtc1	-8.2459	4.0027		Photo	#4
rtc2	-7.6466	4.4882		Photo	#4
rtc3	-6.6605	4.3339		Photo	#4
rtc4	-7.2072	3.8594		Photo	#4
rtc5	-8.1876	2.9329		Photo	#4
cen1	7.4741	2.5460		Photo	#4
cen2	7.7964	3.1067		Photo	#4

cen3	9.1135	2.8838		Photo	#4
cen4	8.8578	2.3307		Photo	#4
cen5	7.3223	1.3686		Photo	#4
cen7	8.9790	1.6500		Photo	#4
cen8	8.6777	1.0756		Photo	#4
lfc1	11.5555	1.8434		Photo	#4
lfc2	11.8081	2.4318		Photo	#4
lfc3	13.2140	2.2240		Photo	#4
lfc4	12.9576	1.6321		Photo	#4
lfc5	11.4202	0.6242		Photo	#4
lfc7	13.0290	0.8806		Photo	#4
lfc8	12.8043	0.3916		Photo	#4
m_r1	-5.0743	1.4645		Photo	#4
m_r4	-4.4616	1.3635		Photo	#4
m_t1	-3.9433	1.9328		Photo	#4
m_t4	-3.2705	1.8217		Photo	#4
m_b1	-4.1263	0.3528		Photo	#4
m_b4	-3.4711	0.1992		Photo	#4
m_l1	-1.5165	0.8221		Photo	#4
m_l4	-0.8750	0.6753		Photo	#4
mtar06	-4.6532	1.7187		Photo	#4
mtar07	-3.4727	2.1945		Photo	#4
mtar08	-1.0737	1.0482		Photo	#4
mtar09	-3.5618	1.6216		Photo	#4
mtar11	-3.6944	0.5716		Photo	#4
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#5	-55.002	0.025	0.025	#5-591	
c	-8.8750	-5.0654		Photo	#5
d	4.0198	-7.8227		Photo	#5
e	3.9235	-9.3762		Photo	#5
g	-5.4097	6.2945		Photo	#5
h	-16.6844	7.7931		Photo	#5
i	-17.2372	-6.0178		Photo	#5
cen1	9.4364	-0.7460		Photo	#5
cen2	10.7194	-0.4372		Photo	#5
cen3	11.6261	-1.1107		Photo	#5
cen4	10.3335	-1.4512		Photo	#5
cen5	9.2890	-2.0696		Photo	#5
cen7	11.4679	-2.4721		Photo	#5
cen8	10.1681	-2.7531		Photo	#5
lfc1	12.2063	-2.8692		Photo	#5
lfc2	13.5391	-2.4966		Photo	#5
lfc3	14.5771	-3.2857		Photo	#5
lfc4	13.2244	-3.6481		Photo	#5
lfc5	12.0106	-4.2997		Photo	#5
lfc7	14.3491	-4.7190		Photo	#5
lfc8	13.0245	-5.0461		Photo	#5
m_t1	-3.9025	2.9597		Photo	#5
m_t4	-3.6723	2.6868		Photo	#5
m_b1	-4.3260	1.5544		Photo	#5
m_b4	-4.0812	1.2501		Photo	#5
m_l1	-1.8748	1.1264		Photo	#5
m_l4	-1.6664	0.8678		Photo	#5
mtar07	-3.5228	3.0140		Photo	#5
mtar08	-1.4640	1.1882		Photo	#5
mtar11	-3.9256	1.6231		Photo	#5
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Site Survey Image Data File

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      #1      -55.003      0.020      0.020  #1-580
    lfc1      -5.7949     5.1351                 Photo        #1
    lfc3      -7.2231     5.4386                 Photo        #1
    lfc4      -6.0735     5.5303                 Photo        #1
    lfc6      -6.9536     3.9166                 Photo        #1
      c1      -4.8557     3.8962                 Photo        #1
      c2      -6.0864     3.7907                 Photo        #1
      c3      -6.3834     4.2044                 Photo        #1
      c4      -5.1808     4.3112                 Photo        #1
      c5      -4.8583     2.7129                 Photo        #1
     xc6      -5.0768     2.6152                 Photo        #1
      c7      -6.3904     3.0784                 Photo        #1
       a       6.7072    -6.5844                 Photo        #1
       b       6.5145    -8.2130                 Photo        #1
      xc      11.6547   -10.4506                 Photo        #1
    rtc1      -0.9865    -7.0918                 Photo        #1
    rtc2      -2.5984    -7.3229                 Photo        #1
    rtc3      -3.0437    -6.3967                 Photo        #1
    rtc6      -2.6446    -8.7351                 Photo        #1
    rtc7      -3.0631    -7.6721                 Photo        #1
     sp1      -0.8812    -5.6827                 Photo        #1
     sp2      -2.5547    -5.8857                 Photo        #1
     sp3      -2.9929    -4.9675                 Photo        #1
     sp4      -1.3947    -4.7651                 Photo        #1
    x+12       7.2373    -4.8752                 Photo        #1
    x+18      11.5754    -4.3390                 Photo        #1
   xx+24      15.6944    -3.8774                 Photo        #1
    y+12      -4.4051    -1.0836                 Photo        #1
    y+06      -3.2994    -3.3892                 Photo        #1
    y-06      -0.4486    -9.1017                 Photo        #1
    z+06      -1.7586    -1.6685                 Photo        #1
    z+12      -1.4802     3.1523                 Photo        #1
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      #2      -55.003      0.020      0.020  #2-736
    lfc1       3.2714     6.5929                 Photo        #2
    lfc2       2.2186     6.7366                 Photo        #2
    lfc3       2.6764     7.0876                 Photo        #2
    lfc4       3.7063     6.9384                 Photo        #2
    lfc5       3.2801     5.5026                 Photo        #2
      c1       1.9758     5.4892                 Photo        #2
      c2       0.8648     5.6429                 Photo        #2
      c3       1.3386     6.0013                 Photo        #2
      c4       2.4146     5.8469                 Photo        #2
      c5       1.9674     4.3411                 Photo        #2
      c6       0.8650     4.5092                 Photo        #2
      c8       2.4153     4.7473                 Photo        #2
       a      -0.0328    -5.9851                 Photo        #2
       b       0.0327    -7.6305                 Photo        #2
       d       7.4512     1.1925                 Photo        #2
       e       7.3906    -0.0977                 Photo        #2
    rtc1      -7.9120    -3.4810                 Photo        #2
    rtc2      -9.1450    -3.2010                 Photo        #2
    rtc4      -7.0908    -2.7661                 Photo        #2
    rtc6      -8.9672    -4.4653                 Photo        #2
    rtc8      -6.9507    -4.0293                 Photo        #2
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sp1	-8.0549	-2.1649		Photo	#2
sp2	-9.3388	-1.8709		Photo	#2
sp3	-8.4818	-1.1543		Photo	#2
sp4	-7.2417	-1.4510		Photo	#2
x+06	-4.291	-3.267		Photo	#2
x+12	-0.1129	-4.3138		Photo	#2
x+18	4.4902	-5.5098		Photo	#2
x+24	9.3853	-6.7941		Photo	#2
y+12	-3.7281	1.6400		Photo	#2
y+06	-5.8430	-0.2239		Photo	#2
y-06	-10.8802	-4.6525		Photo	#2
z+06	-8.7003	1.7261		Photo	#2
z+12	-9.2215	6.1414		Photo	#2
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#3	-55.005	0.020	0.020	#3-674	
lfc1	4.0397	5.5041		Photo	#3
lfc2	3.3822	5.9104		Photo	#3
lfc3	4.3475	6.0686		Photo	#3
lfc4	5.0157	5.6775		Photo	#3
lfc5	3.9276	4.3961		Photo	#3
lfc6	3.2902	4.8045		Photo	#3
lfc8	4.9122	4.5765		Photo	#3
c1	1.0056	5.0284		Photo	#3
c3	1.3874	5.5909		Photo	#3
c4	2.0284	5.1684		Photo	#3
c5	0.9178	3.8817		Photo	#3
c8	1.9329	4.0447		Photo	#3
a	-12.6827	-3.4459		Photo	#3
b	-12.5170	-5.0742		Photo	#3
d	4.9602	-1.0055		Photo	#3
e	4.8275	-2.3334		Photo	#3
rtc1	-16.0460	0.8673		Photo	#3
rtc2	-16.4107	1.3511		Photo	#3
rtc4	-14.7222	1.1431		Photo	#3
sp1	-16.2537	2.1037		Photo	#3
sp2	-16.6145	2.6419		Photo	#3
sp3	-15.2553	2.9138		Photo	#3
sp4	-14.8698	2.3758		Photo	#3
x+06	-14.5019	0.1988		Photo	#3
x+12	-13.1821	-1.7553		Photo	#3
x+18	-11.6577	-4.0109		Photo	#3
x+24	-9.8755	-6.6632		Photo	#3
y+12	-7.9444	3.5109		Photo	#3
y+06	-11.7075	2.7318		Photo	#3
z+06	-16.1786	5.6897		Photo	#3
xz+12	-16.7422	9.7612		Photo	#3
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#4	-55.004	0.020	0.020	#4-623	
lfc1	11.9856	1.2442		Photo	#4
lfc2	12.2511	1.7817		Photo	#4
lfc3	13.6146	1.5487		Photo	#4
lfc4	13.3883	1.0000		Photo	#4
lfc5	11.8238	-0.0178		Photo	#4
c1	7.8991	1.9887		Photo	#4
c2	8.2240	2.4982		Photo	#4
c3	9.5354	2.2570		Photo	#4
c4	9.2529	1.7262		Photo	#4
c5	7.7547	0.7611		Photo	#4
c7	9.3949	1.0326		Photo	#4

c8	9.0995	0.4975		Photo	#4
a	-10.4645	-0.1838		Photo	#4
b	-10.3155	-1.6816		Photo	#4
c	-11.9078	-9.7659		Photo	#4
d	7.4771	-5.5855		Photo	#4
e	7.3383	-7.0749		Photo	#4
rtc1	-7.8348	3.6102		Photo	#4
rtc3	-6.2303	3.8926		Photo	#4
rtc4	-6.7993	3.4752		Photo	#4
sp1	-7.9426	4.7458		Photo	#4
sp2	-7.3425	5.1556		Photo	#4
sp3	-6.3067	5.0077		Photo	#4
sp4	-6.8889	4.6032		Photo	#4
x+06	-8.8910	3.0027		Photo	#4
x+12	-10.9770	1.4999		Photo	#4
x+18	-13.3023	-0.2410		Photo	#4
x+24	-15.9514	-2.2621		Photo	#4
y+12	-0.4666	3.4284		Photo	#4
y+06	-3.8499	3.8573		Photo	#4
y-06	-10.1517	4.7047		Photo	#4
y-12	-13.1429	5.0840		Photo	#4
z+06	-7.3604	7.7035		Photo	#4
z+12	-7.6641	11.3800		Photo	#4
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#5	-55.002	0.020	0.020	#5-591	
lfc1	13.3795	-1.6085		Photo	#5
lfc2	14.7298	-1.2864		Photo	#5
lfc3	15.7318	-2.0111		Photo	#5
lfc4	14.4085	-2.3869		Photo	#5
lfc5	13.2096	-3.0164		Photo	#5
lfc8	14.2222	-3.7791		Photo	#5
c1	10.5775	0.4921		Photo	#5
c2	11.8470	0.8065		Photo	#5
c3	12.7689	0.1301		Photo	#5
c4	11.5012	-0.1853		Photo	#5
c5	10.4317	-0.8291		Photo	#5
c7	12.6007	-1.2216		Photo	#5
c8	11.3409	-1.5308		Photo	#5
a	-2.7736	3.4709		Photo	#5
b	-2.7222	2.0911		Photo	#5
c	-7.6505	-3.8720		Photo	#5
d	5.1662	-6.6614		Photo	#5
e	5.0906	-8.1907		Photo	#5
g	-4.2882	7.4172		Photo	#5
h	-15.3891	8.7627		Photo	#5
i	-15.7543	-4.8527		Photo	#5
rtc1	2.6955	5.8670		Photo	#5
rtc3	4.2374	5.7007		Photo	#5
rtc4	3.1984	5.5125		Photo	#5
sp1	2.6777	6.9694		Photo	#5
sp2	3.7358	7.1549		Photo	#5
sp3	4.2493	6.8127		Photo	#5
sp4	3.1962	6.6312		Photo	#5
x+06	0.2781	5.7630		Photo	#5
x+12	-3.1115	5.1552		Photo	#5
x+18	-6.6368	4.4791		Photo	#5
yx+24	-10.3156	3.7349		Photo	#5
y+12	6.9283	4.0150		Photo	#5
y+06	5.0857	5.2340		Photo	#5

Xy-06	3.9596	7.3648		Photo	#5
y-12	0.5790	8.2080		Photo	#5
z+06	3.4629	9.7016		Photo	#5
********					
#6	-55.005	0.020	0.020	#6-806	
lfc1	2.4619	-7.3557		Photo	#6
lfc2	4.1722	-7.6623		Photo	#6
lfc3	3.6394	-8.6773		Photo	#6
Xlfc4	3.8602	-8.3064		Photo	#6
lfc6	4.1490	-9.1757		Photo	#6
lfc7	3.6160	-10.1749		Photo	#6
lfc8	1.8773	-9.8583		Photo	#6
c1	3.9168	-4.7417		Photo	#6
c2	5.5280	-5.0057		Photo	#6
c3	5.0931	-5.8876		Photo	#6
c4	3.4403	-5.6032		Photo	#6
c7	5.0483	-7.3159		Photo	#6
c8	3.4226	-7.0360		Photo	#6
c	-2.5993	-4.1716		Photo	#6
d	-3.5502	-9.3521		Photo	#6
e	-3.4781	-10.9654		Photo	#6
g	12.5777	3.6942		Photo	#6
h	3.0283	7.6486		Photo	#6
i	-1.7179	-3.7904		Photo	#6
rtc2	11.2539	1.1715		Photo	#6
rtc3	11.0150	0.7755		Photo	#6
rtc4	9.7846	0.9472		Photo	#6
sp1	10.1463	2.5314		Photo	#6
sp2	11.3748	2.3577		Photo	#6
sp3	11.1379	1.9639		Photo	#6
sp4	9.8826	2.1281		Photo	#6
x+06	6.9469	2.1357		Photo	#6
x+12	3.4434	2.5823		Photo	#6
x+18	0.0651	2.9968		Photo	#6
x+24	-3.1824	3.3527		Photo	#6
y+12	8.8903	-1.1057		Photo	#6
y+06	9.7853	0.3410		Photo	#6
y-06	11.2744	2.8317		Photo	#6
y-12	11.9040	3.9156		Photo	#6
z+06	10.8673	5.2170		Photo	#6
z+12	11.1705	9.0396		Photo	#6
********					

Appendix B
GIANT Files

Input Files

GIANT has two input files: Image Data File (IMG.DAT) and Program Options & Input File (OPT.DAT). Examples of Image Data Files were given in Appendix A.

Initial Conditions OPT.DAT File

(Note: Only five cameras were used for this run. Six cameras are normally used.)

```
02111010001009000 11                0.0       0.0
     .0005     .0005     .0005           object space control
  #1-580     -57.092
  #2-736     -56.988
  #3-674     -57.295
  #4-623     -57.434
  #5-591     -57.292
********
      #1      -0.420      -1.298       0.938       0.1       0.1       0.1
      #1  195026.815 -280651.283   41841.376     20000.    20000.    20000.
      #2       0.959      -1.266       0.962       0.1       0.1       0.1
      #2 3325245.322 -292850.340  -15808.992     20000.    20000.    20000.
      #3       1.861      -0.392       0.912       0.1       0.1       0.1
      #3 2993522.783 -282517.808    5422.861     20000.    20000.    20000.
      #4       1.886       1.124       0.863       0.1       0.1       0.1
      #4 2465401.190 -261854.437  -14203.303     20000.    20000.    20000.
      #5       1.003       2.043       0.816       0.1       0.1       0.1
      #5 2020334.515 -261000.348  -22254.677     20000.    20000.    20000.
********
       a      0.2977      0.0099     -0.0707
       b      0.2988      0.0088     -0.1351
       c      0.5555      0.0766     -0.3266
       d      0.2991      0.7227     -0.1620
       e      0.2996      0.7200     -0.2236
       g      0.0549     -0.9181     -0.2093
       h      0.6597     -1.0184     -0.0603
       i      0.8362     -0.6713     -0.7043
    rtc1      0.0252     -0.0249     -0.0250
    rtc2     -0.0247     -0.0250     -0.0261
    rtc3     -0.0252      0.0251     -0.0255
    rtc4      0.0253      0.0250     -0.0253
    rtc6     -0.0246     -0.0254     -0.0767
    rtc7     -0.0246      0.0256     -0.0756
    rtc8      0.0254      0.0252     -0.0765
    cen1      0.0701      0.6693      0.0204
    cen2      0.0197      0.6681      0.0200
    cen3      0.0181      0.7182      0.0163
    cen4      0.0682      0.7196      0.0166
    cen5      0.0706      0.6656     -0.0303
```

```
    cen7        0.0190        0.7157       -0.0337
    cen8        0.0688        0.7164       -0.0336
    lfc1        0.0653        0.8193        0.0114
    lfc2        0.0152        0.8187        0.0111
    lfc3        0.0145        0.8687        0.0085
    lfc4        0.0646        0.8699        0.0088
    lfc5        0.0662        0.8170       -0.0394
    lfc6        0.0156        0.8152       -0.0391
    lfc8        0.0648        0.8673       -0.0411
********
```

Body Anthropometry OPT.DAT File

```
02111000001009000 10
    .00025    .00025    .00025
LfEyLfSh    -838.200
RtEyLfSh    -838.200
LfEyRtSh    -838.200
RtEyRtSh    -838.200
********
LfEyLfSh       0.506      -0.451      -0.080    0.01      0.01     0.01
LfEyLfSh 3151911.056   -1059.271    1647.281   10000.    10000.   10000.
RtEyLfSh       0.548      -0.413      -0.078    0.01      0.01     0.01
RtEyLfSh 3150729.283   -1631.101   10108.979   10000.    10000.   10000.
LfEyRtSh       0.515       0.470      -0.068    0.01      0.01     0.01
LfEyRtSh 2223804.999  -13008.431  -13520.960   10000.    10000.   10000.
RtEyRtSh       0.483       0.499      -0.067    0.01      0.01     0.01
RtEyRtSh 2221908.014  -13824.763  -12002.768   10000.    10000.   10000.
********
r1           0.0325     -0.0468      0.00356
r2           0.0309     -0.0460     -0.02190
r3           0.0309     -0.0241     -0.02180
r4           0.0315     -0.0242      0.00280
r5           0.0523     -0.0460      0.00305
r6           0.0521     -0.0467     -0.02200
r7           0.0526     -0.0232     -0.02160
r8           0.0532     -0.0243      0.00330
c1          -0.03073    -0.00731     0.00178
c2          -0.03073    -0.00698    -0.01870
c3          -0.03073     0.01422    -0.02286
c4          -0.03100     0.01574     0.00254
c5          -0.00813    -0.00757     0.00254
c6          -0.00838    -0.00879    -0.01994
c7          -0.00787     0.01550    -0.02060
c8          -0.00762     0.01641     0.00216
l1           0.03048     0.03300     0.00317
l2           0.03073     0.03380    -0.02020
l3           0.03109     0.05500    -0.02060
l4           0.03020     0.05640     0.00330
l5           0.05385     0.03400     0.00315
l6           0.05260     0.03400    -0.02010
l7           0.05160     0.05550    -0.02060
l8           0.05385     0.05610     0.00315
********
```

Body Anthropometry OPT.DAT File — Premount Modification

```
HRV # 0227
00001010001109000   2
0.000250  0.000250  0.000250
LfEyLfSh    -889.000      0.250      0.250
RtEyLfSh    -889.000      0.250      0.250
LfEyRtSh    -889.000      0.250      0.250
RtEyRtSh    -889.000      0.250      0.250
********
LfEyLfSh      -0.446       0.003       0.724    0.04       0.04     0.04
LfEyLfSh  -30753.786  324055.341   53224.185   20000.     20000.   50000.
RtEyLfSh      -0.412      -0.004       0.750    0.04       0.04     0.04
RtEyLfSh  -25648.055  365055.966   42450.451   20000.     20000.   50000.
LfEyRtSh       0.310       0.013       0.825    0.04       0.04     0.04
LfEyRtSh    1216.754 -285642.826  -21733.348   20000.     20000.   50000.
RtEyRtSh       0.413       0.022       0.780    0.04       0.04     0.04
RtEyRtSh     902.372 -294739.770  -21416.237   20000.     20000.   50000.
********
     ctp       .0000       .0000       .0000                              0
     rtp      -.0889       .0000       .0635                              0
     ltp       .0889       .0000       .0635                              0
********
```

Head Anthropometry OPT.DAT File

```
02111000001009000 11
    .00025    .00025    .00025 object space control -- instrument coordinates
     #1-580     -57.092
      #2-736     -56.988
      #3-674     -57.295
      #4-623     -57.434
      #5-591     -57.292
      #6-806     -57.539
********
      #1      -0.215      -1.296      -0.704      .010      .010      .010
      #1  123907.524  212026.467 1140044.621    10000.    10000.    10000.
      #2      -0.681      -1.365       0.234      .010      .010      .010
      #2  281640.865 -145943.634 1233733.229    10000.   100000.    10000.
      #3      -0.881      -0.523       0.734      .010      .010      .010
      #3  643038.319 -451500.948 1565717.778    10000.    10000.    10000.
      #4      -0.870       0.156       0.750      .010      .010      .010
      #4  950102.260 -463437.760-1773742.194    10000.    10000.    10000.
      #5      -0.669       0.994       0.337      .010      .010      .010
      #5 1375856.349 -263803.624-1350102.512    10000.    10000.    10000.
      #6      -0.217       0.995      -0.568      .010      .010      .010
      #6 1633732.172  160415.301-1105627.125    10000.    10000.    10000.
********
    mrc1      .02950     -.04813      .00457
    mrc2      .02950     -.04813     -.02032
    mrc3      .02950     -.02375     -.02032
    mrc4      .02950     -.02375      .00457
    mrc5      .05490     -.04813      .00457
    mrc6      .05490     -.04813     -.02032
    mrc7      .05490     -.02375     -.02032
    mrc8      .05490     -.02375      .00457
    mcc1     -.03200     -.00838      .00457
    mcc2     -.03200     -.00838     -.02172
    mcc3     -.03200      .01753     -.02172
    mcc4     -.03200      .01753      .00457
    mcc5     -.00635     -.00838      .00457
    mcc6     -.00635     -.00838     -.02172
    mcc7     -.00635      .01753     -.02172
    mcc8     -.00635      .01753      .00457
    mlc1      .02980      .03152      .00508
    mlc2      .02980      .03152     -.02045
    mlc3      .02980      .05705     -.02045
    mlc4      .02980      .05705      .00508
    mlc5      .05480      .03152      .00508
    mlc6      .05476      .03152     -.02045
    mlc7      .05480      .05705     -.02045
    mlc8      .05480      .05705      .00508
********
```

Head Anthropometry OPT.DAT File — Premount Modification

```
HRV # 0222
00001010001109000   1
0.000250  0.000250  0.000250
 AP  CAM    -1820.09
 LAT CAM    - 889.00
********
A/Phrv45        1.068        0.577        1.160    0.10       0.10     0.10
A/Phrv45   211014.306  -491537.856    84935.941   10000.     10000.   10000.
A/Pprism        0.523        0.234        1.618    0.10       0.10     0.10
A/Pprism    15412.372  -224814.291    -4329.419   10000.     10000.   10000.
LAThrv45       -0.500        0.259        0.672    0.10       0.10     0.10
LAThrv45   190143.916   392138.153  -165243.147   10000.     10000.   10000.
LATprism       -0.645        0.172        0.415    0.10       0.10     0.10
LATprism    32255.040   682534.993   -20135.417   10000.     10000.   10000.
********
c1            -0.0469       0.0508       0.0194   0.0005     0.0005   0.0005   0
c2            -0.2347       0.0508       0.0972   0.0005     0.0005   0.0005   0
c3            -0.2347       0.2540       0.0972   0.0005     0.0005   0.0005   0
c4            -0.0469       0.2540       0.0194   0.0005     0.0005   0.0005   0
c5             0.0237       0.2540       0.0573   0.0005     0.0005   0.0005   0
c6             0.0194       0.0508       0.0469   0.0005     0.0005   0.0005   0
c7             0.0972       0.0508       0.2347   0.0005     0.0005   0.0005   0
c8             0.0972       0.2540       0.2347   0.0005     0.0005   0.0005   0
c9             0.0503       0.1524       0.2541                               0
c10           -0.0825       0.1524       0.1991                               0
c11           -0.2152       0.1524       0.1441                               0
c12           -0.0825       0.0508       0.1991                               0
c13           -0.0825       0.2540       0.1991                               0
********
```

Site Survey OPT.DAT File

```
02111010001009000 11                0.0       0.0
    0.0005    0.0005    0.0005           object space control
  #1-580     -57.092
  #2-736     -56.988
  #3-674     -57.295
  #4-623     -57.434
  #5-591     -57.292
  #6-806     -57.539
********
      #1      -0.420      -1.298       0.938       0.1       0.1       0.1
      #1  195026.815 -280651.283   41841.376    20000.    20000.    20000.
      #2       0.959      -1.266       0.962       0.1       0.1       0.1
      #2 3325245.322 -292850.340  -15808.992    20000.    20000.    20000.
      #3       1.861      -0.392       0.912       0.1       0.1       0.1
      #3 2993522.783 -282517.808    5422.861    20000.    20000.    20000.
      #4       1.886       1.124       0.863       0.1       0.1       0.1
      #4 2465401.190 -261854.437  -14203.303    20000.    20000.    20000.
      #5       1.003       2.043       0.816       0.1       0.1       0.1
      #5 2020334.515 -261000.348  -22254.677    20000.    20000.    20000.
      #6      -0.361       2.092       0.787       0.1       0.1       0.1
      #6 1583448.831 -222547.057   -1108.903    20000.    20000.    20000.
********
     sp1       0.0254     -0.0254      0.0254
     sp2      -0.0254     -0.0254      0.0254
     sp3      -0.0254      0.0254      0.0254
     sp4       0.0254      0.0254      0.0254
    rtc1       0.0254     -0.0254     -0.0254
    rtc2      -0.0254     -0.0254     -0.0254
    rtc3      -0.0254      0.0254     -0.0254
    rtc4       0.0254      0.0254     -0.0254
    rtc5       0.0254     -0.0254     -0.0762
    rtc6      -0.0254     -0.0254     -0.0762
    rtc7      -0.0254      0.0254     -0.0762
    rtc8       0.0254      0.0254     -0.0762
    z+12       0.0000      0.0000      0.3048
    z+06       0.0000      0.0000      0.1524
    y+12       0.0000      0.3048      0.0000
    y+06       0.0000      0.1524      0.0000
    y-06       0.0000     -0.1524      0.0000
    y-12       0.0000     -0.3048      0.0000
    x+24       0.6048      0.0000      0.0000
    x+18       0.4572      0.0000      0.0000
    x+12       0.3048      0.0000      0.0000
    x+06       0.1524      0.0000      0.0000
********
      #2         .600      -1.500       .600       0.2       0.2       0.2
      #2  710920.170  272650.444   90718.956      500.      500.      500.
      #3       1.500       0.000       .600       0.2       0.2       0.2
      #3  492355.502  664443.019  395816.778      500.      500.      500.
      #4       1.500        .600        .600       0.2       0.2       0.2
      #4 -101342.721  713806.049 1002814.067      500.      500.      500.
      #5        .600       2.700        .600       0.2       0.2       0.2
      #5 -612956.739  410812.461 1601544.882      500.      500.      500.
      #6       -.300       2.700        .600       0.2       0.2       0.2
      #6 -663405.275  -82306.154-1755645.212      500.      500.      500.
```

Output Files

Initial Conditions Output File

```
NBDL GIANT: 08:47   05/19/92                                          Page  1
    35mm Still Camera System For Initial Conditions Of     RUN # = LX6422

                  Object Space Reference System is Rectangular

                 Rotation angles are Terrestrial Object-to-Photo

                   Complete Triangulation process is requested

                         Error Propagation is requested

                           [Variance/Covariance output]

        Unit Variance will be based on completely free camera parameters

                        All Image Residuals will be listed

                  Triangulated Object Coordinates will not be saved

                  Adjusted Camera Station Parameters will be saved


NBDL GIANT: 08:47   05/19/92                                          Page  2
    35mm Still Camera System For Initial Conditions Of     RUN # = LX6422

                             E R R O R    W A R N I N G S


                               POINTS NOT PHOTOGRAPHED

                        rtc7


                               PASS POINTS APPEARING ON 1 PHOTO

                        *   cen1    *   cen3    *   cen5    *   cen7
                        *   lfc1    *   lfc2    *   lfc4    *   lfc6


NBDL GIANT: 08:47   05/19/92                                          Page  3
    35mm Still Camera System For Initial Conditions Of     RUN # = LX6422

              C A M E R A    S T A T I O N S    C O R R E C T I O N S

             ------- P O S I T I O N -------   --------- A T T I T U D E ------
```

	X	Y	Z	Azim.	Elev.	Swing
			Iteration 1			
#1	0.0045	0.0320	-0.0175 m.	-0.053781	-0.016545	-0.030237
#2	0.0110	0.0194	-0.0004 m.	-0.034333	-0.014277	-0.023851
#3	0.0075	0.0197	0.0144 m.	0.018638	-0.051629	0.033912
#4	-0.0065	0.0106	-0.0028 m.	-0.005101	0.012266	-0.021293
#5	0.0080	-0.0048	-0.0066 m.	0.030224	-0.018579	0.015213

Provisional Weighted Sum of Squares = 634521.

			Iteration 2			
#1	-0.0006	-0.0076	0.0035 m.	0.001399	-0.000585	-0.001253
#2	-0.0114	-0.0087	0.0020 m.	-0.007168	0.000838	0.000339
#3	0.0010	-0.0012	-0.0006 m.	-0.000375	-0.000185	0.000226
#4	0.0013	-0.0012	-0.0006 m.	0.000628	0.000346	0.000065
#5	0.0004	0.0011	0.0014 m.	-0.000296	-0.000139	0.000113

Provisional Weighted Sum of Squares = 1176.94

			Iteration 3			
#1	0.0000	0.0000	0.0000 m.	0.000001	-0.000010	-0.000014
#2	0.0004	0.0003	0.0000 m.	0.000244	-0.000077	0.000011
#3	0.0000	0.0000	0.0000 m.	-0.000008	0.000037	-0.000031
#4	0.0000	0.0000	0.0000 m.	0.000019	0.000017	-0.000012
#5	0.0000	0.0000	0.0000 m.	-0.000003	0.000003	-0.000004

Provisional Weighted Sum of Squares = 274.075

			Iteration 4			
#1	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000
#2	0.0000	0.0000	0.0000 m.	-0.000004	0.000006	-0.000002
#3	0.0000	0.0000	0.0000 m.	0.000000	-0.000001	0.000001
#4	0.0000	0.0000	0.0000 m.	0.000000	-0.000001	0.000001
#5	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000

Provisional Weighted Sum of Squares = 274.024

NBDL GIANT: 08:47 05/19/92 Page 4
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

a *0*	#1	#2	#3	#4
	19	0	-39	22
	40	-30	-50	27
b *0*	#1	#2	#3	#4
	2	-6	-19	16
	9	-19	-22	21
c *0*	#2	#1	#4	#5
	30	-59	-6	-28
	-34	4	8	62
rtc1 *0*	#2	#3	#1	#4
	8	-22	14	-2
	-13	-19	-4	24
rtc2 *0*	#1	#2	#3	#4
	-3	-12	14	-38
	4	46	-9	-57
rtc3 *0*	#1	#2	#3	#4
	-19	41	17	1
	5	8	-29	-8
rtc4 *0*	#2	#1	#3	#4
	-2	-23	5	-21
	16	15	24	4
rtc5	#2	#3	#1	#4
	-4	-5	12	19
	1	0	-2	2
rtc6 *0*	#1	#2	#3	
	0	13	26	
	-54	-25	110	
cen2 *0*	#3	#1	#4	#5
	9	-40	0	-26
	0	-6	-17	6
cen6	#1	#3		
	0	1		
	-3	3		
lfc7	#1	#4	#5	
	32	-6	18	
	-17	33	-16	
m_r1	#2	#3	#4	#1
	3	-9	10	2
	0	-12	5	6

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

TRIANGULATED IMAGE POINTS (in micrometers)					RESIDUALS
m_r4	#2	#1	#3	#4	
	16	0	-3	6	
	-7	-18	16	8	
m_t1	#1	#2	#3	#4	#5
	25	-3	1	9	11
	-11	11	-16	21	-7
m_t4	#3	#2	#1	#4	#5
	21	-12	-7	-29	4
	32	-25	16	-13	-9
m_b1	#3	#1	#2	#4	#5
	7	19	-14	-13	10
	25	10	-11	-3	-22
m_b4	#3	#2	#1	#4	#5
	28	-10	10	0	-2
	15	-19	-25	18	5
mtar01	#1	#3	#2		
	0	-3	-11		
	12	-32	20		
mtar03	#3	#1	#2		
	12	12	-10		
	16	-12	-6		
mtar06	#3	#2	#1	#4	
	5	-23	4	-11	
	-10	26	7	-23	
mtar07	#3	#1	#2	#4	#5
	5	1	-5	-12	12
	18	21	-20	-26	8
mtar11	#1	#2	#3	#4	#5
	-3	-4	-6	0	-1
	1	39	-45	14	-8
rtc8 *0*	#2	#3			
	0	18			
	25	4			
mtar09	#3	#4	#2		
	-16	6	6		
	-11	-7	19		
d *0*	#4	#5	#3		
	37	-39	-4		
	-11	-38	14		

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

e *0*	#4	#3	#5
	29	13	-22
	-13	13	-45
f	#3	#4	
	2	2	
	-20	18	
cen1 *0*	#4	#5	#3
	5	-6	-13
	15	9	-8
cen3 *0*	#3	#4	#5
	-6	3	-12
	-18	-22	3
cen4 *0*	#3	#4	#5
	-23	-22	4
	10	-12	13
cen5 *0*	#4	#5	#3
	17	-11	0
	-29	18	-5
cen8 *0*	#3	#5	#4
	-4	0	5
	-6	-14	18
lfc1 *0*	#3	#5	#4
	-17	18	0
	0	6	23
lfc2 *0*	#4	#3	#5
	-2	6	13
	-7	13	-15
lfc3 *0*	#4	#5	#3
	-26	10	20
	-24	18	-14
lfc4 *0*	#5	#4	#3
	16	9	-7
	15	3	-13
lfc5 *0*	#5	#3	#4
	31	-7	-11
	31	-33	-12
lfc6 *0*	#3		
	1		
	30		

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

lfc8 *0*	#4	#5	#3
	-8	20	-11
	-2	3	33
m_l1	#4	#5	#3
	-4	1	3
	9	-7	-3
m_l4	#5	#3	#4
	-5	0	-4
	-25	3	22
mtar08	#4	#5	#3
	7	-7	-6
	2	-3	1
cen7 *0*	#5	#4	
	-28	14	
	18	-10	
g *0*	#5		
	-59		
	-23		
h *0*	#5		
	47		
	-30		
i *0*	#5		
	18		
	47		

Weighted Sum of Squares (Camera) =	10.6
Weighted Sum of Squares (Object) =	23.0
Weighted Sum of Squares (Plates) =	198.9
Weighted Sum of Squares (Total) =	232.6
Degrees of Freedom..... =	219

a posteriori Variance of Unit Weight = 1.062

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D C A M E R A S T A T I O N S
(Terrestrial->Ph)

Ident	Position/Attitude		Covariance Matrix		
#1	X =	-0.4161 m.	+6.464E-06	-1.127E-06	+1.874E-06
	Y =	-1.2737 m.	-1.127E-06	+3.629E-06	-1.916E-06
	Z =	0.9240 m.	+1.874E-06	-1.916E-06	+1.211E-05
	Azim. =	23 23 7.7343	+2.215E-06	-8.075E-07	-9.951E-07
	Elev. =-	28 28 22.2050	-8.075E-07	+2.215E-06	-9.951E-07
	Swing =	04 30 20.1043	-9.951E-07	-9.951E-07	+1.899E-06
#2	X =	0.9589 m.	+8.445E-05	+1.558E-05	-2.980E-05
	Y =	-1.2551 m.	+1.558E-05	+3.261E-05	+3.255E-05
	Z =	0.9635 m.	-2.980E-05	+3.255E-05	+7.439E-05
	Azim. =	335 20 18.8974	+2.659E-05	+5.336E-06	-5.121E-06
	Elev. =-	30 44 10.5319	+5.336E-06	+2.659E-05	-5.121E-06
	Swing =-	02 22 27.9251	-5.121E-06	-5.121E-06	+7.303E-06
#3	X =	1.8695 m.	+5.670E-06	+4.617E-06	-1.719E-07
	Y =	-0.3735 m.	+4.617E-06	+8.153E-06	+2.155E-06
	Z =	0.9258 m.	-1.719E-07	+2.155E-06	+7.046E-06
	Azim. =	297 15 51.8284	+1.768E-06	-6.505E-07	+5.537E-08
	Elev. =-	29 08 19.2178	-6.505E-07	+1.768E-06	+5.537E-08
	Swing =-	00 32 43.9160	+5.537E-08	+5.537E-08	+4.103E-06
#4	X =	1.8808 m.	+4.551E-06	-3.575E-06	-1.163E-06
	Y =	1.1334 m.	-3.575E-06	+8.362E-06	-2.180E-06
	Z =	0.8596 m.	-1.163E-06	-2.180E-06	+7.209E-06
	Azim. =	247 02 10.9444	+1.828E-06	+3.716E-07	-6.554E-08
	Elev. =-	26 46 59.3300	+3.716E-07	+1.828E-06	-6.554E-08
	Swing =-	02 15 41.0295	-6.554E-08	-6.554E-08	+5.368E-06
#5	X =	1.0114 m.	+6.005E-06	+1.816E-06	+1.160E-06
	Y =	2.0392 m.	+1.816E-06	+1.593E-06	-2.155E-07
	Z =	0.8108 m.	+1.160E-06	-2.155E-07	+5.105E-06
	Azim. =	203 43 47.2399	+8.511E-07	-1.164E-07	+4.012E-07
	Elev. =-	24 52 19.6241	-1.164E-07	+8.511E-07	+4.012E-07
	Swing =-	01 09 39.0473	+4.012E-07	+4.012E-07	+1.824E-06

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

		X =	0.0046 m.	Azim. =	00 08 51.9034
Count =	5	Y =	0.0033 m.	Elev. =	00 10 24.0679
		Z =	0.0046 m.	Swing =	00 06 57.6248

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

TRIANGULATED OBJECT POINTS

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
		X =	0.2974	+1.740E-07	+6.278E-09	+1.107E-08	0.0004
a	*0*	Y =	0.0104	+6.278E-09	+1.653E-07	-1.666E-08	0.0004
		Z =	-0.0706	+1.107E-08	-1.666E-08	+1.631E-07	0.0004
		X =	0.2989	+1.677E-07	+4.085E-09	+1.403E-08	0.0004
b	*0*	Y =	0.0091	+4.085E-09	+1.622E-07	-1.839E-08	0.0004
		Z =	-0.1350	+1.403E-08	-1.839E-08	+1.634E-07	0.0004
		X =	0.5555	+1.869E-07	+7.241E-09	+1.116E-08	0.0004
c	*0*	Y =	0.0768	+7.241E-09	+1.947E-07	+2.325E-09	0.0004
		Z =	-0.3269	+1.116E-08	+2.325E-09	+1.948E-07	0.0004
		X =	0.2987	+1.884E-07	+8.421E-09	+3.027E-08	0.0004
d	*0*	Y =	0.7222	+8.421E-09	+1.711E-07	+1.450E-08	0.0004
		Z =	-0.1616	+3.027E-08	+1.450E-08	+1.751E-07	0.0004
		X =	0.2992	+1.894E-07	+8.250E-09	+3.095E-08	0.0004
e	*0*	Y =	0.7193	+8.250E-09	+1.702E-07	+1.494E-08	0.0004
		Z =	-0.2231	+3.095E-08	+1.494E-08	+1.784E-07	0.0004
		X =	-1.3294	+4.304E-05	-4.595E-06	+1.208E-05	0.0066
f		Y =	0.7979	-4.595E-06	+4.974E-06	-1.245E-06	0.0022
		Z =	-0.1228	+1.208E-05	-1.245E-06	+7.801E-06	0.0028
		X =	0.0545	+2.488E-07	+4.645E-09	+2.198E-09	0.0005
g	*0*	Y =	-0.9180	+4.645E-09	+2.627E-07	+3.735E-09	0.0005
		Z =	-0.2092	+2.198E-09	+3.735E-09	+2.526E-07	0.0005
		X =	0.6600	+2.454E-07	+2.079E-09	+8.145E-10	0.0005
h	*0*	Y =	-1.0185	+2.079E-09	+2.637E-07	+5.551E-09	0.0005
		Z =	-0.0600	+8.145E-10	+5.551E-09	+2.457E-07	0.0005
		X =	0.8364	+2.462E-07	+1.675E-10	+1.937E-09	0.0005
i	*0*	Y =	-0.6712	+1.675E-10	+2.603E-07	+9.387E-09	0.0005
		Z =	-0.7046	+1.937E-09	+9.387E-09	+2.485E-07	0.0005
		X =	0.0702	+1.965E-07	+1.487E-08	+2.825E-08	0.0004
cen1	*0*	Y =	0.6695	+1.487E-08	+1.697E-07	+1.042E-08	0.0004
		Z =	0.0202	+2.825E-08	+1.042E-08	+1.635E-07	0.0004
		X =	0.0197	+1.825E-07	+1.510E-08	+2.446E-08	0.0004
cen2	*0*	Y =	0.6682	+1.510E-08	+1.669E-07	+4.339E-09	0.0004
		Z =	0.0202	+2.446E-08	+4.339E-09	+1.556E-07	0.0004
		X =	0.0179	+1.989E-07	+1.525E-08	+2.814E-08	0.0004
cen3	*0*	Y =	0.7183	+1.525E-08	+1.694E-07	+1.058E-08	0.0004
		Z =	0.0166	+2.814E-08	+1.058E-08	+1.653E-07	0.0004
		X =	0.0683	+1.959E-07	+1.498E-08	+2.846E-08	0.0004
cen4	*0*	Y =	0.7200	+1.498E-08	+1.683E-07	+1.073E-08	0.0004
		Z =	0.0165	+2.846E-08	+1.073E-08	+1.634E-07	0.0004

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
	X =	0.0704	+1.964E-07	+1.444E-08	+2.914E-08		0.0004
cen5	*0* Y =	0.6656	+1.444E-08	+1.699E-07	+1.124E-08		0.0004
	Z =	-0.0302	+2.914E-08	+1.124E-08	+1.661E-07		0.0004
	X =	0.0204	+1.276E-06	-4.484E-07	+4.119E-07		0.0011
cen6	Y =	0.6633	-4.484E-07	+1.674E-06	-6.546E-07		0.0013
	Z =	-0.0311	+4.119E-07	-6.546E-07	+1.154E-06		0.0011
	X =	0.0187	+2.118E-07	+2.906E-08	+2.738E-08		0.0005
cen7	*0* Y =	0.7158	+2.906E-08	+1.926E-07	+2.005E-08		0.0004
	Z =	-0.0338	+2.738E-08	+2.005E-08	+1.859E-07		0.0004
	X =	0.0689	+1.958E-07	+1.451E-08	+2.941E-08		0.0004
cen8	*0* Y =	0.7163	+1.451E-08	+1.687E-07	+1.151E-08		0.0004
	Z =	-0.0336	+2.941E-08	+1.151E-08	+1.660E-07		0.0004
	X =	0.0657	+1.949E-07	+1.510E-08	+2.895E-08		0.0004
lfc1	*0* Y =	0.8194	+1.510E-08	+1.658E-07	+1.135E-08		0.0004
	Z =	0.0111	+2.895E-08	+1.135E-08	+1.634E-07		0.0004
	X =	0.0153	+1.983E-07	+1.518E-08	+2.871E-08		0.0004
lfc2	*0* Y =	0.8185	+1.518E-08	+1.675E-07	+1.128E-08		0.0004
	Z =	0.0112	+2.871E-08	+1.128E-08	+1.651E-07		0.0004
	X =	0.0144	+1.982E-07	+1.501E-08	+2.910E-08		0.0004
lfc3	*0* Y =	0.8688	+1.501E-08	+1.668E-07	+1.162E-08		0.0004
	Z =	0.0087	+2.910E-08	+1.162E-08	+1.652E-07		0.0004
	X =	0.0649	+1.946E-07	+1.507E-08	+2.928E-08		0.0004
lfc4	*0* Y =	0.8698	+1.507E-08	+1.647E-07	+1.164E-08		0.0004
	Z =	0.0087	+2.928E-08	+1.164E-08	+1.637E-07		0.0004
	X =	0.0665	+1.949E-07	+1.454E-08	+3.007E-08		0.0004
lfc5	*0* Y =	0.8172	+1.454E-08	+1.665E-07	+1.198E-08		0.0004
	Z =	-0.0394	+3.007E-08	+1.198E-08	+1.662E-07		0.0004
	X =	0.0157	+2.481E-07	-1.635E-08	+1.336E-08		0.0005
lfc6	*0* Y =	0.8151	-1.635E-08	+2.329E-07	-8.751E-09		0.0005
	Z =	-0.0394	+1.336E-08	-8.751E-09	+2.291E-07		0.0005
	X =	0.0151	+1.081E-06	+5.146E-07	+4.363E-07		0.0010
lfc7	Y =	0.8667	+5.146E-07	+7.990E-07	+2.980E-07		0.0009
	Z =	-0.0435	+4.363E-07	+2.980E-07	+6.476E-07		0.0008
	X =	0.0652	+1.947E-07	+1.448E-08	+3.047E-08		0.0004
lfc8	*0* Y =	0.8673	+1.448E-08	+1.656E-07	+1.212E-08		0.0004
	Z =	-0.0414	+3.047E-08	+1.212E-08	+1.665E-07		0.0004
	X =	0.4426	+4.856E-07	+8.406E-08	+9.592E-08		0.0007
m_b1	Y =	0.3770	+8.406E-08	+6.617E-07	+8.215E-09		0.0008
	Z =	0.0610	+9.592E-08	+8.215E-09	+3.880E-07		0.0006

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
	X =	0.4432	+4.992E-07	+8.936E-08	+1.046E-07		0.0007
m_b4	Y =	0.4015	+8.936E-08	+6.729E-07	+1.740E-08		0.0008
	Z =	0.0603	+1.046E-07	+1.740E-08	+3.979E-07		0.0006
	X =	0.3785	+8.510E-07	+1.769E-07	+2.904E-07		0.0009
m_l1	Y =	0.4429	+1.769E-07	+7.128E-07	+1.356E-07		0.0008
	Z =	0.0587	+2.904E-07	+1.356E-07	+5.603E-07		0.0007
	X =	0.3812	+8.431E-07	+1.713E-07	+2.877E-07		0.0009
m_l4	Y =	0.4672	+1.713E-07	+7.102E-07	+1.338E-07		0.0008
	Z =	0.0586	+2.877E-07	+1.338E-07	+5.608E-07		0.0007
	X =	0.3750	+5.278E-07	+2.259E-08	+1.052E-07		0.0007
m_r1	Y =	0.3092	+2.259E-08	+6.204E-07	-7.672E-08		0.0008
	Z =	0.0614	+1.052E-07	-7.672E-08	+4.199E-07		0.0006
	X =	0.3758	+5.416E-07	+2.388E-08	+1.134E-07		0.0007
m_r4	Y =	0.3328	+2.388E-08	+6.331E-07	-7.194E-08		0.0008
	Z =	0.0615	+1.134E-07	-7.194E-08	+4.289E-07		0.0007
	X =	0.4255	+4.964E-07	+8.312E-08	+8.654E-08		0.0007
m_t1	Y =	0.3801	+8.312E-08	+6.831E-07	+5.775E-09		0.0008
	Z =	0.1119	+8.654E-08	+5.775E-09	+3.749E-07		0.0006
	X =	0.4261	+5.068E-07	+8.763E-08	+9.454E-08		0.0007
m_t4	Y =	0.4031	+8.763E-08	+6.929E-07	+1.373E-08		0.0008
	Z =	0.1102	+9.454E-08	+1.373E-08	+3.838E-07		0.0006
	X =	0.0249	+1.628E-07	-2.363E-09	+1.401E-08		0.0004
rtc1 *0*	Y =	-0.0244	-2.363E-09	+1.626E-07	-2.030E-08		0.0004
	Z =	-0.0249	+1.401E-08	-2.030E-08	+1.584E-07		0.0004
	X =	-0.0249	+1.652E-07	-3.041E-09	+1.378E-08		0.0004
rtc2 *0*	Y =	-0.0251	-3.041E-09	+1.657E-07	-2.079E-08		0.0004
	Z =	-0.0261	+1.378E-08	-2.079E-08	+1.616E-07		0.0004
	X =	-0.0255	+1.653E-07	-2.973E-09	+1.354E-08		0.0004
rtc3 *0*	Y =	0.0245	-2.973E-09	+1.660E-07	-2.070E-08		0.0004
	Z =	-0.0252	+1.354E-08	-2.070E-08	+1.604E-07		0.0004
	X =	0.0256	+1.617E-07	-2.712E-09	+1.443E-08		0.0004
rtc4 *0*	Y =	0.0248	-2.712E-09	+1.627E-07	-2.035E-08		0.0004
	Z =	-0.0259	+1.443E-08	-2.035E-08	+1.564E-07		0.0004
	X =	0.0266	+4.157E-07	-3.722E-08	+9.723E-08		0.0006
rtc5	Y =	-0.0255	-3.722E-08	+4.379E-07	-1.485E-07		0.0007
	Z =	-0.0747	+9.723E-08	-1.485E-07	+4.311E-07		0.0007
	X =	-0.0243	+1.716E-07	-9.050E-09	+1.208E-08		0.0004
rtc6 *0*	Y =	-0.0254	-9.050E-09	+1.803E-07	-2.972E-08		0.0004
	Z =	-0.0768	+1.208E-08	-2.972E-08	+1.762E-07		0.0004

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)	Covariance Matrix			Std Dev (m)
	X =	0.0254	+2.146E-07	-2.335E-08	+2.792E-08	0.0005
rtc8	*0* Y =	0.0248	-2.335E-08	+1.945E-07	-2.030E-08	0.0004
	Z =	-0.0768	+2.792E-08	-2.030E-08	+1.982E-07	0.0004
	X =	0.3598	+5.951E-07	-1.162E-07	+1.476E-07	0.0008
mtar01	Y =	0.3080	-1.162E-07	+9.873E-07	-3.053E-07	0.0010
	Z =	0.0551	+1.476E-07	-3.053E-07	+6.109E-07	0.0008
	X =	0.4105	+6.704E-07	-1.140E-07	+1.567E-07	0.0008
mtar03	Y =	0.3786	-1.140E-07	+1.149E-06	-2.941E-07	0.0011
	Z =	0.1055	+1.567E-07	-2.941E-07	+6.479E-07	0.0008
	X =	0.3653	+5.319E-07	+2.035E-08	+1.078E-07	0.0007
mtar06	Y =	0.3201	+2.035E-08	+6.211E-07	-7.385E-08	0.0008
	Z =	0.0672	+1.078E-07	-7.385E-08	+4.183E-07	0.0006
	X =	0.4159	+4.996E-07	+8.401E-08	+9.004E-08	0.0007
mtar07	Y =	0.3921	+8.401E-08	+6.815E-07	+9.648E-09	0.0008
	Z =	0.1170	+9.004E-08	+9.648E-09	+3.740E-07	0.0006
	X =	0.3688	+8.512E-07	+1.766E-07	+2.885E-07	0.0009
mtar08	Y =	0.4555	+1.766E-07	+7.038E-07	+1.331E-07	0.0008
	Z =	0.0642	+2.885E-07	+1.331E-07	+5.532E-07	0.0007
	X =	0.4217	+8.977E-07	-6.048E-08	+2.875E-07	0.0009
mtar09	Y =	0.3911	-6.048E-08	+7.958E-07	-7.179E-08	0.0009
	Z =	0.0995	+2.875E-07	-7.179E-08	+6.158E-07	0.0008
	X =	0.4324	+4.891E-07	+8.507E-08	+9.887E-08	0.0007
mtar11	Y =	0.3887	+8.507E-08	+6.600E-07	+1.215E-08	0.0008
	Z =	0.0667	+9.887E-08	+1.215E-08	+3.863E-07	0.0006

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

Count =	19	X =	0.0017 meters
Count =	19	Y =	0.0010 meters
Count =	19	Z =	0.0010 meters

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

	X =	0.0004 m		X =	-0.0003 m
lfc1	Y =	0.0001 m	rtc1	Y =	0.0005 m
	Z =	-0.0003 m		Z =	0.0001 m
	X =	0.0001 m		X =	0.0001 m
cen1	Y =	0.0002 m	lfc2	Y =	-0.0002 m
	Z =	-0.0002 m		Z =	0.0001 m

	X =	-0.0002 m		X =	0.0000 m
rtc2	Y =	-0.0001 m	cen2	Y =	0.0001 m
	Z =	0.0000 m		Z =	0.0002 m
	X =	-0.0001 m		X =	-0.0003 m
lfc3	Y =	0.0001 m	rtc3	Y =	-0.0006 m
	Z =	0.0002 m		Z =	0.0003 m
	X =	-0.0002 m		X =	0.0003 m
cen3	Y =	0.0001 m	lfc4	Y =	-0.0001 m
	Z =	0.0003 m		Z =	-0.0001 m
	X =	0.0003 m		X =	0.0001 m
rtc4	Y =	-0.0002 m	cen4	Y =	0.0004 m
	Z =	-0.0006 m		Z =	-0.0001 m
	X =	0.0003 m		X =	-0.0002 m
lfc5	Y =	0.0002 m	cen5	Y =	0.0000 m
	Z =	0.0000 m		Z =	0.0001 m
	X =	0.0001 m		X =	0.0003 m
lfc6	Y =	-0.0001 m	rtc6	Y =	0.0000 m
	Z =	-0.0003 m		Z =	-0.0001 m
	X =	-0.0003 m		X =	0.0004 m
cen7	Y =	0.0001 m	lfc8	Y =	0.0000 m
	Z =	-0.0001 m		Z =	-0.0003 m
	X =	0.0000 m		X =	0.0001 m
rtc8	Y =	-0.0004 m	cen8	Y =	-0.0001 m
	Z =	-0.0003 m		Z =	0.0000 m
	X =	-0.0003 m		X =	0.0001 m
a	Y =	0.0005 m	b	Y =	0.0003 m
	Z =	0.0001 m		Z =	0.0001 m
	X =	0.0000 m		X =	-0.0004 m
c	Y =	0.0002 m	d	Y =	-0.0005 m
	Z =	-0.0003 m		Z =	0.0004 m
	X =	-0.0004 m		X =	-0.0004 m
e	Y =	-0.0007 m	g	Y =	0.0001 m
	Z =	0.0005 m		Z =	0.0001 m

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35mm Still Camera System For Initial Conditions Of RUN # = LX6422

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

	X =	0.0003 m		X =	0.0002 m
h	Y =	-0.0001 m	i	Y =	0.0001 m
	Z =	0.0003 m		Z =	-0.0003 m

X .... Number of Components =	28	RMS =	0.0003 meters
Y .... Number of Components =	28	RMS =	0.0003 meters
Z .... Number of Components =	28	RMS =	0.0003 meters

Initial Conditions Variables Output File

```
MOUT
mrc1
-0.8648E-01  0.4629E+00  0.1269E+01
 0.9093E-06 -0.6112E-07  0.2316E-06
-0.6112E-07  0.7139E-06 -0.1220E-06
 0.2316E-06 -0.1220E-06  0.5972E-06
mrc2
-0.1076E+00  0.4632E+00  0.1279E+01
 0.9149E-06 -0.6451E-07  0.2245E-06
-0.6451E-07  0.7217E-06 -0.1228E-06
 0.2245E-06 -0.1228E-06  0.5902E-06
mrc3
-0.1077E+00  0.4877E+00  0.1278E+01
 0.1180E-05 -0.1490E-06  0.8757E-07
-0.1490E-06  0.6389E-05 -0.2296E-05
 0.8757E-07 -0.2296E-05  0.1990E-05
mrc4
-0.8646E-01  0.4860E+00  0.1267E+01
 0.1124E-05 -0.4158E-06  0.3245E-06
-0.4158E-06  0.1481E-05 -0.4862E-06
 0.3245E-06 -0.4862E-06  0.9088E-06
mrc5
-0.9708E-01  0.4618E+00  0.1247E+01
 0.9150E-06 -0.6718E-07  0.2429E-06
-0.6718E-07  0.7240E-06 -0.1321E-06
 0.2429E-06 -0.1321E-06  0.6160E-06
mrc6
-0.1192E+00  0.4632E+00  0.1257E+01
 0.1112E-05 -0.3978E-06  0.3177E-06
-0.3978E-06  0.1463E-05 -0.4859E-06
 0.3177E-06 -0.4859E-06  0.9078E-06
mrc8
-0.9644E-01  0.4851E+00  0.1247E+01
 0.1772E-05 -0.3121E-06  0.6742E-06
-0.3121E-06  0.8256E-06 -0.1980E-06
 0.6742E-06 -0.1980E-06  0.9296E-06
mcc1
-0.5581E-01  0.5008E+00  0.1320E+01
 0.4963E-06 -0.8871E-08  0.7922E-07
-0.8871E-08  0.5400E-06  0.1556E-07
 0.7922E-07  0.1556E-07  0.3653E-06
mcc2
-0.7629E-01  0.5012E+00  0.1331E+01
 0.4924E-06 -0.7829E-08  0.7519E-07
-0.7829E-08  0.5429E-06  0.1690E-07
 0.7519E-07  0.1690E-07  0.3583E-06
mcc3
-0.7654E-01  0.5244E+00  0.1330E+01
 0.4914E-06 -0.1173E-07  0.7500E-07
-0.1173E-07  0.5382E-06  0.2014E-07
 0.7500E-07  0.2014E-07  0.3569E-06
mcc4
-0.5577E-01  0.5243E+00  0.1319E+01
 0.4955E-06 -0.1291E-07  0.7911E-07
-0.1291E-07  0.5353E-06  0.1879E-07
```

```
 0.7911E-07  0.1879E-07  0.3640E-06
mcc5
-0.6706E-01  0.5015E+00  0.1298E+01
 0.6681E-06  0.5306E-07  0.1510E-06
 0.5306E-07  0.6056E-06 -0.7331E-08
 0.1510E-06 -0.7331E-08  0.4541E-06
mcc6
-0.8913E-01  0.5006E+00  0.1309E+01
 0.1128E-05 -0.4259E-06  0.2983E-06
-0.4259E-06  0.1499E-05 -0.4519E-06
 0.2983E-06 -0.4519E-06  0.8629E-06
mcc7
-0.8884E-01  0.5244E+00  0.1310E+01
 0.3775E-05  0.2246E-05  0.1791E-05
 0.2246E-05  0.2502E-05  0.1348E-05
 0.1791E-05  0.1348E-05  0.1757E-05
mcc8
-0.6609E-01  0.5244E+00  0.1298E+01
 0.5921E-06 -0.4204E-07  0.1162E-06
-0.4204E-07  0.5729E-06  0.4435E-07
 0.1162E-06  0.4435E-07  0.4262E-06
mlc1
-0.8271E-01  0.5402E+00  0.1266E+01
 0.8253E-06  0.1786E-06  0.2136E-06
 0.1786E-06  0.1012E-05  0.3492E-06
 0.2136E-06  0.3492E-06  0.7516E-06
mlc2
-0.1051E+00  0.5392E+00  0.1277E+01
 0.3976E-05  0.2308E-05  0.1999E-05
 0.2308E-05  0.2505E-05  0.1455E-05
 0.1999E-05  0.1455E-05  0.1948E-05
mlc3
-0.1036E+00  0.5633E+00  0.1278E+01
 0.1519E-05  0.2323E-06  0.5673E-06
 0.2323E-06  0.7246E-06  0.1619E-06
 0.5673E-06  0.1619E-06  0.8159E-06
mlc4
-0.8294E-01  0.5628E+00  0.1266E+01
 0.7063E-06  0.1768E-08  0.1617E-06
 0.1768E-08  0.6098E-06  0.1124E-06
 0.1617E-06  0.1124E-06  0.5203E-06
mlc5
-0.9514E-01  0.5393E+00  0.1245E+01
 0.1533E-05  0.2380E-06  0.6140E-06
 0.2380E-06  0.7394E-06  0.1739E-06
 0.6140E-06  0.1739E-06  0.8753E-06
mlc7
-0.1154E+00  0.5644E+00  0.1256E+01
 0.8123E-06  0.1706E-06  0.2090E-06
 0.1706E-06  0.9951E-06  0.3556E-06
 0.2090E-06  0.3556E-06  0.7489E-06
mlc8
-0.9365E-01  0.5631E+00  0.1245E+01
 0.7120E-06  0.6653E-08  0.1706E-06
 0.6653E-08  0.6166E-06  0.1209E-06
 0.1706E-06  0.1209E-06  0.5373E-06
EOFEOF
NECK
nrc1
```

```
-0.4[illegible]00  0.4776E+00  0.1298E+01
 0.47[illegible]-06 -0.2392E-07  0.5230E-07
-0.2392E-07  0.8547E-06  0.3863E-07
 0.5230E-07  0.3863E-07  0.4152E-06
nrc2
-0.4169E+00  0.4769E+00  0.1274E+01
 0.1217E-05 -0.5895E-06  0.3408E-06
-0.5895E-06  0.1903E-05 -0.6128E-06
 0.3408E-06 -0.6128E-06  0.9826E-06
nrc4
-0.4156E+00  0.5013E+00  0.1297E+01
 0.8176E-06 -0.4946E-07  0.1461E-06
-0.4946E-07  0.1036E-05 -0.1327E-06
 0.1461E-06 -0.1327E-06  0.6077E-06
nrc5
-0.3915E+00  0.4771E+00  0.1297E+01
 0.4772E-06 -0.2757E-07  0.5198E-07
-0.2757E-07  0.8471E-06  0.3636E-07
 0.5198E-07  0.3636E-07  0.4142E-06
nrc6
-0.3926E+00  0.4756E+00  0.1273E+01
 0.8046E-06 -0.5173E-07  0.1487E-06
-0.5173E-07  0.1023E-05 -0.1439E-06
 0.1487E-06 -0.1439E-06  0.6149E-06
nrc7
-0.3917E+00  0.4999E+00  0.1271E+01
 0.1577E-05 -0.1488E-06  0.4309E-06
-0.1488E-06  0.1111E-05 -0.5962E-07
 0.4309E-06 -0.5962E-07  0.8985E-06
nrc8
-0.3909E+00  0.5006E+00  0.1296E+01
 0.4722E-06 -0.2556E-07  0.5084E-07
-0.2556E-07  0.8426E-06  0.4789E-07
 0.5084E-07  0.4789E-07  0.4130E-06
ncc1
-0.4759E+00  0.5038E+00  0.1298E+01
 0.4683E-06 -0.9856E-08  0.5362E-07
-0.9856E-08  0.8679E-06  0.5707E-07
 0.5362E-07  0.5707E-07  0.4195E-06
ncc2
-0.4755E+00  0.5010E+00  0.1274E+01
 0.1398E-05 -0.1409E-05  0.5925E-06
-0.1409E-05  0.7676E-05 -0.2836E-05
 0.5925E-06 -0.2836E-05  0.2213E-05
ncc3
-0.4757E+00  0.5315E+00  0.1274E+01
 0.6341E-06  0.6131E-07 -0.1935E-08
 0.6131E-07  0.3477E-05  0.6309E-06
-0.1935E-08  0.6309E-06  0.9106E-06
ncc4
-0.4754E+00  0.5278E+00  0.1296E+01
 0.5392E-06 -0.1542E-06  0.3631E-07
-0.1542E-06  0.1196E-05  0.4205E-07
 0.3631E-07  0.4205E-07  0.4985E-06
ncc5
-0.4520E+00  0.5033E+00  0.1299E+01
 0.4839E-06  0.5372E-07  0.4304E-07
 0.5372E-07  0.1350E-05  0.1379E-06
 0.4304E-07  0.1379E-06  0.5007E-06
```

```
ncc6
-0.4518E+00  0.4986E+00  0.1275E+01
 0.1357E-05 -0.1291E-05  0.5438E-06
-0.1291E-05  0.7511E-05 -0.2769E-05
 0.5438E-06 -0.2769E-05  0.2177E-05
ncc8
-0.4515E+00  0.5268E+00  0.1297E+01
 0.5791E-06  0.2720E-06  0.8541E-07
 0.2720E-06  0.1927E-05  0.3870E-06
 0.8541E-07  0.3870E-06  0.6536E-06
nlc1
-0.4154E+00  0.5561E+00  0.1294E+01
 0.8009E-06  0.3342E-06  0.2306E-06
 0.3342E-06  0.1309E-05  0.4913E-06
 0.2306E-06  0.4913E-06  0.7726E-06
nlc3
-0.4166E+00  0.5774E+00  0.1268E+01
 0.7915E-06  0.3223E-06  0.2375E-06
 0.3223E-06  0.1274E-05  0.5088E-06
 0.2375E-06  0.5088E-06  0.8008E-06
nlc4
-0.4155E+00  0.5776E+00  0.1292E+01
 0.6030E-06  0.1010E-06  0.1146E-06
 0.1010E-06  0.9140E-06  0.2391E-06
 0.1146E-06  0.2391E-06  0.5483E-06
nlc5
-0.3912E+00  0.5542E+00  0.1293E+01
 0.4724E-06  0.6826E-07  0.6348E-07
 0.6826E-07  0.8051E-06  0.1057E-06
 0.6348E-07  0.1057E-06  0.4162E-06
nlc6
-0.3909E+00  0.5528E+00  0.1270E+01
 0.1766E-05  0.3526E-06  0.5265E-06
 0.3526E-06  0.1101E-05  0.1662E-06
 0.5265E-06  0.1662E-06  0.9276E-06
nlc7
-0.3922E+00  0.5773E+00  0.1267E+01
 0.6131E-06  0.9385E-07  0.1188E-06
 0.9385E-07  0.9022E-06  0.2410E-06
 0.1188E-06  0.2410E-06  0.5648E-06
nlc8
-0.3915E+00  0.5776E+00  0.1291E+01
 0.4680E-06  0.6728E-07  0.6385E-07
 0.6728E-07  0.7895E-06  0.1145E-06
 0.6385E-07  0.1145E-06  0.4159E-06
EOFEOF
EOFEOF
```

Head Anthropometry Output File

```
NBDL GIANT: 09:17   10/13/92                                          Page  1
    35mm Still Camera System for Head Anthropometry of      HRV # = 0253

                Object Space Reference System is Rectangular

                Rotation angles are Terrestrial Object-to-Photo

                Complete Triangulation process is requested

                      Error Propagation is requested

                        [Variance/Covariance output]

          Unit Variance will be based on completely free camera parameters

                      All Image Residuals will be listed

                    Triangulated Object Coordinates will be saved

                  Adjusted Camera Station Parameters will be saved
```

```
NBDL GIANT: 09:17   10/13/92                                          Page  2
    35mm Still Camera System for Head Anthropometry of      HRV # = 0253

                          E R R O R    W A R N I N G S


                            POINTS NOT PHOTOGRAPHED

                       mrc7          mlc6


                      PASS POINTS APPEARING ON 1 PHOTO

                          j             k     *       a     *       j
                    *   rtc5          lfc7    *       b           rtc7
                    *   cen1      *   lfc1    *    lfc3     *    lfc7
```

```
NBDL GIANT: 09:17   10/13/92                                          Page  3
    35mm Still Camera System for Head Anthropometry of      HRV # = 0253

                  C A M E R A    S T A T I O N S    C O R R E C T I O N S

                 ------- P O S I T I O N -------   --------- A T T I T U D E ------

                   X           Y           Z              Azim.       Elev.       Swing

                                      Iteration   1
```

#1	-0.0037	0.0023	-0.0120 m.	-0.004066	0.008765	0.015261
#2	-0.0128	0.0011	-0.0112 m.	-0.009281	0.007311	0.009436
#3	-0.0116	0.0032	-0.0095 m.	-0.011792	0.001311	-0.000853
#4	-0.0070	0.0022	-0.0092 m.	-0.009982	-0.003119	-0.007529
#5	-0.0002	0.0021	-0.0046 m.	-0.002934	-0.005424	-0.013494
#6	0.0098	0.0038	-0.0001 m.	0.006825	0.000337	-0.009053

Provisional Weighted Sum of Squares = 210.083

NBDL GIANT: 09:17 10/13/92 Page 4
35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

a	#1	#3	#4		
	-2	5	-5		
	2	0	-1		
rtc1	#2	#1	#3	#4	#6
	-3	6	-24	9	-10
	-24	23	10	25	-32
rtc2	#2	#3	#1	#4	#6
	-2	-47	-42	10	-57
	8	8	28	-17	-24
rtc3	#1	#2	#3	#4	#6
	-1	-18	19	24	-11
	-17	-5	3	-11	34
rtc4	#2	#1	#3	#4	#6
	13	-9	21	-12	1
	9	-22	4	1	13
rtc5	#1	#3	#4		
	-3	-5	3		
	13	-62	50		
rtc6	#2	#3	#1		
	-48	50	29		
	-19	29	-5		
ear1-r	#2	#3	#4	#5	#1
	67	-32	-27	54	-10
	-15	-27	17	10	20
ear2-r	#2	#3	#1	#4	#5
	52	-18	-29	-19	13
	6	5	0	-17	12
ear3-r	#2	#1	#3	#4	
	40	-23	-19	-1	
	-7	3	-10	19	
ear4-r	#2	#3	#1	#4	
	31	-11	-11	3	

	-18	-3	-7	30
mrc1 *0*	#3	#1	#2	#4
	2	24	16	-52
	-40	11	2	-46
mrc2 *0*	#2	#3	#4	#1
	75	-5	-22	93
	37	-3	-14	23

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

mrc3 *0*	#1	#2				
	37	1				
	-14	-3				
mrc4 *0*	#1					
	95					
	-17					
mrc5 *0*	#1	#3	#2	#4		
	8	-1	-8	-17		
	15	-51	32	-56		
mrc6 *0*	#3	#1	#2			
	55	24	-3			
	14	3	-24			
mcc1 *0*	#2	#3	#4	#5	#1	#6
	-13	0	-17	5	-13	47
	25	45	21	23	20	-41
mcc2 *0*	#1	#3	#2	#4	#5	#6
	-40	18	-28	44	71	113
	4	45	76	85	45	-25
mcc3 *0*	#3	#1	#4	#5	#2	#6
	26	-64	67	44	-64	-51
	50	23	67	1	-14	28
mcc4 *0*	#1	#3	#2	#4	#5	#6
	-17	86	5	39	-10	8
	-62	75	4	21	-16	-9
mcc5 *0*	#3	#2	#1	#4	#5	
	-40	-58	-49	-18	32	
	17	-20	-20	-10	-2	
b	#4	#2	#3	#5		
	-10	43	-33	25		
	23	-35	-4	14		

c	#3	#2	#5	
	65	-59	-39	
	-16	24	-9	
d	#4	#2	#5	
	52	-34	-41	
	-7	9	2	
rtc8	#4	#3	#2	#6
	28	31	-71	-50
	0	19	-32	15

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

cen1	#2	#4	#5	#3
	31	-13	18	-16
	-18	13	7	-4
cen3	#4	#5	#2	#6
	27	-20	21	23
	-35	-16	0	28
cen4	#5	#2	#4	#6
	10	47	0	25
	-27	-7	-43	43
cen5	#2	#4	#5	
	2	-1	-2	
	-9	26	-14	
cen8	#5	#2	#4	#6
	-20	47	-10	18
	8	-19	32	-16
lfc5	#3	#4	#5	#2
	-4	-19	11	14
	-22	3	-5	30
lfc6	#2	#3		
	3	1		
	-15	15		
ron	#4	#2	#3	
	7	13	-7	
	17	-26	6	
mrc8 *0*	#4	#3	#2	
	-7	0	-48	
	-23	6	97	
* g	#3	#4		
	1	0		

	28	-28		
* h	#4	#3		
	-1	0		
	1	-1		
lfc1	#5	#4	[illegible]	
	6	-11	11	
	23	-16	-12	
lfc2	#5	#3	#4	#6
	-16	5	12	7
	11	-30	17	-2

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

lfc3	#5	#4	#3	
	12	-26	24	
	28	-15	-23	
lfc4	#4	#5	#3	#6
	-49	24	14	-9
	6	-3	16	-8
lfc8	#4	#5	#6	#3
	-58	-9	-19	1
	42	36	-60	41
lon	#5	#4	#3	
	1	-10	5	
	-13	11	1	
ear1-1	#5	#6	#4	#3
	24	-47	2	-64
	9	-15	13	1
ear2-1	#5	#4	#6	#3
	-1	23	-17	-40
	10	16	-9	-13
ear3-1	#5	#4	#3	#6
	17	3	-56	-41
	0	30	-1	-22
ear4-1	#5	#4	#3	#6
	23	13	-52	-34
	5	7	-3	-5
mcc6 *0*	#3			
	-6			
	38			

mcc8 *0*	#5	#4	#3	#6
	-4	20	61	35
	-14	-12	20	-13
mlc3 *0*	#4	#3	#5	#6
	12	-6	-9	-8
	-40	-46	8	0
mlc4 *0*	#5	#4	#3	#6
	-41	-1	35	-5
	-27	-62	-62	2
mlc5 *0*	#5	#4	#3	
	-73	-48	-40	
	45	-58	-2	

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

mlc8 *0*	#4	#3	#5	#6
	-2	6	-63	15
	-70	-29	-72	61
f	#4	#5		
	-2	0		
	1	0		
cen2	#5	#6	#4	
	-11	16	33	
	-21	40	-49	
mcc7 *0*	#5	#4		
	74	54		
	-30	52		
mlc1 *0*	#4	#6	#5	
	-39	67	-58	
	-9	6	0	
mlc7 *0*	#4	#5	#6	
	-43	-58	-21	
	0	-32	5	
mlc2 *0*	#5			
	-17			
	11			

Weighted Sum of Squares (Camera) =	13.4
Weighted Sum of Squares (Object) =	5.9
Weighted Sum of Squares (Plates) =	138.1
Weighted Sum of Squares (Total) =	157.5

Degrees of Freedom..... = 281

a posteriori Variance of Unit Weight = 0.561

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D C A M E R A S T A T I O N S
(Terrestrial->Ph)

Ident	Position/Attitude		Covariance Matrix		
	X =	-0.2187 m.	+2.893E-05	-5.079E-07	+3.698E-06
#1	Y =	-1.2937 m.	-5.079E-07	+1.430E-05	-5.242E-06
	Z =	-0.7160 m.	+3.698E-06	-5.242E-06	+2.392E-05
	Azim. =	12 56 44.6550	+1.448E-05	-2.413E-06	-4.987E-06
	Elev. =	21 48 39.6688	-2.413E-06	+1.448E-05	-4.987E-06
	Swing =	114 40 31.2480	-4.987E-06	-4.987E-06	+1.477E-05
	X =	-0.6938 m.	+1.718E-05	-9.827E-07	-7.527E-07
#2	Y =	-1.3639 m.	-9.827E-07	+1.625E-05	+5.055E-06
	Z =	0.2228 m.	-7.527E-07	+5.055E-06	+1.695E-05
	Azim. =	28 46 12.0780	+7.090E-06	+1.332E-06	+1.180E-06
	Elev. =	-14 33 15.9342	+1.332E-06	+7.090E-06	+1.180E-06
	Swing =	124 05 54.9347	+1.180E-06	+1.180E-06	+9.408E-06
	X =	-0.8926 m.	+9.775E-06	-1.612E-07	+2.053E-07
#3	Y =	-0.5198 m.	-1.612E-07	+9.656E-06	+4.694E-07
	Z =	0.7245 m.	+2.053E-07	+4.694E-07	+8.215E-06
	Azim. =	64 58 22.8413	+5.695E-06	+3.802E-07	-2.040E-07
	Elev. =	-44 39 22.8442	+3.802E-07	+5.695E-06	-2.040E-07
	Swing =	157 11 4.8682	-2.040E-07	-2.040E-07	+8.996E-06
	X =	-0.8770 m.	+7.769E-06	-3.785E-08	+3.781E-07
#4	Y =	0.1582 m.	-3.785E-08	+8.131E-06	-3.584E-07
	Z =	0.7408 m.	+3.781E-07	-3.584E-07	+7.453E-06
	Azim. =	95 06 10.2226	+5.611E-06	+2.523E-07	-8.249E-08
	Elev. =	-45 59 37.3703	+2.523E-07	+5.611E-06	-8.249E-08
	Swing =	-177 52 29.6638	-8.249E-08	-8.249E-08	+9.655E-06
	X =	-0.6692 m.	+1.176E-05	+9.495E-07	+8.579E-07
#5	Y =	0.9961 m.	+9.495E-07	+1.332E-05	-2.766E-06
	Z =	0.3324 m.	+8.579E-07	-2.766E-06	+1.163E-05
	Azim. =	137 54 42.4899	+8.145E-06	-7.442E-07	-5.724E-07
	Elev. =	-26 20 27.0130	-7.442E-07	+8.145E-06	-5.724E-07
	Swing =	-135 38 8.4042	-5.724E-07	-5.724E-07	+1.055E-05
	X =	-0.2072 m.	+9.331E-06	+7.847E-08	-1.787E-06
#6	Y =	0.9988 m.	+7.847E-08	+6.603E-06	-4.572E-07
	Z =	-0.5681 m.	-1.787E-06	-4.572E-07	+1.008E-05
	Azim. =	164 01 58.1799	+6.987E-06	-1.267E-06	-1.007E-06
	Elev. =	16 05 1.2088	-1.267E-06	+6.987E-06	-1.007E-06
	Swing =	-111 34 39.0138	-1.007E-06	-1.007E-06	+7.405E-06

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

		X =	0.0038 m.	Azim. =	00 09 43.4565
Count =	6	Y =	0.0034 m.	Elev. =	00 11 26.0755
		Z =	0.0036 m.	Swing =	00 10 56.5213

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)		Covariance Matrix			Std Dev (m)
	X =	0.0324	+3.124E-06	-3.583E-07	-7.127E-07	0.0018
a	Y =	-0.0593	-3.583E-07	+2.895E-06	+1.427E-07	0.0017
	Z =	-0.6096	-7.127E-07	+1.427E-07	+2.597E-06	0.0016
	X =	0.0433	+2.916E-06	-7.169E-08	-7.855E-07	0.0017
b	Y =	0.0940	-7.169E-08	+2.714E-06	-4.694E-08	0.0016
	Z =	-0.6061	-7.855E-07	-4.694E-08	+2.745E-06	0.0017
	X =	0.3055	+3.274E-06	+2.198E-07	-8.627E-07	0.0018
c	Y =	-0.0671	+2.198E-07	+2.632E-06	-3.183E-07	0.0016
	Z =	-0.4791	-8.627E-07	-3.183E-07	+2.870E-06	0.0017
	X =	0.3069	+3.358E-06	-1.059E-07	-1.023E-06	0.0018
d	Y =	0.0869	-1.059E-07	+2.528E-06	+4.636E-08	0.0016
	Z =	-0.4758	-1.023E-06	+4.636E-08	+2.962E-06	0.0017
	X =	0.3498	+5.384E-06	-1.095E-06	-2.368E-06	0.0023
f	Y =	0.2866	-1.095E-06	+2.267E-06	+7.869E-07	0.0015
	Z =	-0.2119	-2.368E-06	+7.869E-07	+3.278E-06	0.0018
	X =	-0.0109	+8.230E-07	-1.097E-07	-4.178E-07	0.0009
lon	Y =	0.0409	-1.097E-07	+4.692E-07	+7.710E-08	0.0007
	Z =	-0.0856	-4.178E-07	+7.710E-08	+6.973E-07	0.0008
	X =	-0.0134	+1.067E-06	+2.586E-07	-6.071E-07	0.0010
ron	Y =	-0.0256	+2.586E-07	+5.706E-07	-2.152E-07	0.0008
	Z =	-0.0856	-6.071E-07	-2.152E-07	+9.157E-07	0.0010
	X =	0.1108	+2.326E-06	-1.259E-08	-6.995E-07	0.0015
cen1	Y =	0.1857	-1.259E-08	+2.020E-06	-1.671E-08	0.0014
	Z =	-0.4690	-6.995E-07	-1.671E-08	+2.171E-06	0.0015
	X =	0.1308	+2.350E-06	-3.573E-07	-4.329E-07	0.0015
cen2	Y =	0.1897	-3.573E-07	+2.701E-06	+1.774E-07	0.0016
	Z =	-0.5119	-4.329E-07	+1.774E-07	+1.986E-06	0.0014
	X =	0.1318	+2.302E-06	-1.874E-07	-4.092E-07	0.0015
cen3	Y =	0.2405	-1.874E-07	+2.565E-06	+7.776E-08	0.0016
	Z =	-0.5091	-4.092E-07	+7.776E-08	+2.025E-06	0.0014
	X =	0.1110	+2.000E-06	-1.568E-07	-3.724E-07	0.0014

cen4	Y =	0.2367	-1.568E-07	+2.259E-06	+3.259E-08	0.0015
	Z =	-0.4646	-3.724E-07	+3.259E-08	+1.779E-06	0.0013
	X =	0.1558	+2.555E-06	-1.753E-07	-8.167E-07	0.0016
cen5	Y =	0.1834	-1.753E-07	+2.159E-06	+1.560E-07	0.0015
	Z =	-0.4458	-8.167E-07	+1.560E-07	+2.351E-06	0.0015
	X =	0.1566	+1.978E-06	-1.953E-07	-3.173E-07	0.0014
cen8	Y =	0.2344	-1.953E-07	+2.136E-06	+1.159E-08	0.0015
	Z =	-0.4425	-3.173E-07	+1.159E-08	+1.696E-06	0.0013

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Covariance Matrix		Std Dev (m)
	X =	0.1102	+3.170E-06	-7.730E-08	-1.314E-06	0.0018
lfc1	Y =	0.3391	-7.730E-08	+2.378E-06	+1.202E-07	0.0015
	Z =	-0.4580	-1.314E-06	+1.202E-07	+3.284E-06	0.0018
	X =	0.1312	+2.573E-06	-1.361E-07	-5.076E-07	0.0016
lfc2	Y =	0.3420	-1.361E-07	+2.635E-06	+5.898E-08	0.0016
	Z =	-0.5027	-5.076E-07	+5.898E-08	+2.368E-06	0.0015
	X =	0.1325	+3.793E-06	-4.265E-08	-1.579E-06	0.0019
lfc3	Y =	0.3909	-4.265E-08	+2.833E-06	+1.151E-07	0.0017
	Z =	-0.5017	-1.579E-06	+1.151E-07	+4.006E-06	0.0020
	X =	0.1102	+2.433E-06	-7.554E-08	-5.062E-07	0.0016
lfc4	Y =	0.3892	-7.554E-08	+2.449E-06	-3.214E-08	0.0016
	Z =	-0.4549	-5.062E-07	-3.214E-08	+2.329E-06	0.0015
	X =	0.1557	+2.750E-06	+7.287E-08	-8.866E-07	0.0017
lfc5	Y =	0.3375	+7.287E-08	+2.267E-06	-4.266E-08	0.0015
	Z =	-0.4361	-8.866E-07	-4.266E-08	+2.649E-06	0.0016
	X =	0.1766	+8.240E-06	+6.098E-06	-5.662E-06	0.0029
lfc6	Y =	0.3385	+6.098E-06	+1.049E-05	-6.343E-06	0.0032
	Z =	-0.4782	-5.662E-06	-6.343E-06	+8.561E-06	0.0029
	X =	0.1551	+2.412E-06	-1.240E-07	-4.319E-07	0.0016
lfc8	Y =	0.3872	-1.240E-07	+2.305E-06	-5.033E-08	0.0015
	Z =	-0.4330	-4.319E-07	-5.033E-08	+2.215E-06	0.0015
	X =	-0.0320	+3.044E-08	-8.260E-11	-8.990E-10	0.0002
mcc1 *0*	Y =	-0.0084	-8.260E-11	+3.151E-08	-1.829E-10	0.0002
	Z =	0.0047	-8.990E-10	-1.829E-10	+3.023E-08	0.0002
	X =	-0.0320	+3.044E-08	-9.430E-11	-9.290E-10	0.0002
mcc2 *0*	Y =	-0.0085	-9.430E-11	+3.157E-08	-1.729E-10	0.0002
	Z =	-0.0214	-9.290E-10	-1.729E-10	+3.030E-08	0.0002
	X =	-0.0319	+3.040E-08	-1.180E-10	-9.309E-10	0.0002
mcc3 *0*	Y =	0.0174	-1.180E-10	+3.157E-08	-1.993E-10	0.0002
	Z =	-0.0216	-9.309E-10	-1.993E-10	+3.029E-08	0.0002

		X =	-0.0320	+3.040E-08	-1.048E-10	-8.932E-10	0.0002
mcc4	*0*	Y =	0.0174	-1.048E-10	+3.150E-08	-2.313E-10	0.0002
		Z =	0.0046	-8.932E-10	-2.313E-10	+3.022E-08	0.0002
		X =	-0.0064	+3.155E-08	+4.584E-11	-1.148E-09	0.0002
mcc5	*0*	Y =	-0.0083	+4.584E-11	+3.181E-08	+3.130E-10	0.0002
		Z =	0.0047	-1.148E-09	+3.130E-10	+3.097E-08	0.0002
		X =	-0.0063	+3.436E-08	+3.521E-10	-5.350E-10	0.0002
mcc6	*0*	Y =	-0.0084	+3.521E-10	+3.396E-08	-3.236E-10	0.0002
		Z =	-0.0217	-5.350E-10	-3.236E-10	+3.419E-08	0.0002

TRIANGULATED OBJECT POINTS

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
		X =	-0.0064	+3.345E-08	-6.711E-10	-8.623E-10	0.0002
mcc7	*0*	Y =	0.0174	-6.711E-10	+3.312E-08	+4.343E-10	0.0002
		Z =	-0.0216	-8.623E-10	+4.343E-10	+3.301E-08	0.0002
		X =	-0.0064	+3.158E-08	-4.633E-10	-1.032E-09	0.0002
mcc8	*0*	Y =	0.0175	-4.633E-10	+3.177E-08	-4.414E-10	0.0002
		Z =	0.0046	-1.032E-09	-4.414E-10	+3.117E-08	0.0002
		X =	0.0298	+3.224E-08	-8.427E-10	-6.180E-10	0.0002
mlc1	*0*	Y =	0.0316	-8.427E-10	+3.270E-08	-2.143E-10	0.0002
		Z =	0.0051	-6.180E-10	-2.143E-10	+3.187E-08	0.0002
		X =	0.0298	+3.412E-08	-5.846E-10	-2.080E-10	0.0002
mlc2	*0*	Y =	0.0315	-5.846E-10	+3.449E-08	+3.164E-10	0.0002
		Z =	-0.0205	-2.080E-10	+3.164E-10	+3.377E-08	0.0002
		X =	0.0298	+3.176E-08	-4.666E-10	-9.084E-10	0.0002
mlc3	*0*	Y =	0.0571	-4.666E-10	+3.193E-08	-4.660E-10	0.0002
		Z =	-0.0205	-9.084E-10	-4.660E-10	+3.136E-08	0.0002
		X =	0.0297	+3.175E-08	-4.734E-10	-9.252E-10	0.0002
mlc4	*0*	Y =	0.0570	-4.734E-10	+3.185E-08	-5.009E-10	0.0002
		Z =	0.0049	-9.252E-10	-5.009E-10	+3.126E-08	0.0002
		X =	0.0548	+3.311E-08	-3.030E-10	-1.195E-09	0.0002
mlc5	*0*	Y =	0.0316	-3.030E-10	+3.230E-08	+7.522E-11	0.0002
		Z =	0.0050	-1.195E-09	+7.522E-11	+3.230E-08	0.0002
		X =	0.0548	+3.239E-08	-7.849E-10	-5.438E-10	0.0002
mlc7	*0*	Y =	0.0571	-7.849E-10	+3.279E-08	-2.320E-10	0.0002
		Z =	-0.0205	-5.438E-10	-2.320E-10	+3.204E-08	0.0002
		X =	0.0548	+3.191E-08	-4.740E-10	-8.788E-10	0.0002
mlc8	*0*	Y =	0.0571	-4.740E-10	+3.195E-08	-4.772E-10	0.0002
		Z =	0.0050	-8.788E-10	-4.772E-10	+3.140E-08	0.0002
		X =	0.0295	+3.247E-08	+5.335E-10	-1.008E-09	0.0002
mrc1	*0*	Y =	-0.0481	+5.335E-10	+3.230E-08	+1.241E-10	0.0002

		Z =	0.0045	-1.008E-09	+1.241E-10	+3.206E-08	0.0002
		X =	0.0296	+3.248E-08	+5.214E-10	-9.715E-10	0.0002
mrc2	*0*	Y =	-0.0481	+5.214E-10	+3.237E-08	+9.889E-11	0.0002
		Z =	-0.0204	-9.715E-10	+9.889E-11	+3.214E-08	0.0002
		X =	0.0295	+3.352E-08	+4.497E-10	+1.193E-11	0.0002
mrc3	*0*	Y =	-0.0237	+4.497E-10	+3.461E-08	+2.461E-10	0.0002
		Z =	-0.0203	+1.193E-11	+2.461E-10	+3.352E-08	0.0002
		X =	0.0295	+3.415E-08	+1.281E-10	+7.458E-11	0.0002
mrc4	*0*	Y =	-0.0237	+1.281E-10	+3.480E-08	+3.775E-10	0.0002
		Z =	0.0045	+7.458E-11	+3.775E-10	+3.433E-08	0.0002

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
		X =	0.0549	+3.259E-08	+5.252E-10	-9.521E-10	0.0002
mrc5	*0*	Y =	-0.0481	+5.252E-10	+3.239E-08	+1.225E-10	0.0002
		Z =	0.0045	-9.521E-10	+1.225E-10	+3.217E-08	0.0002
		X =	0.0549	+3.306E-08	+7.095E-10	-4.301E-10	0.0002
mrc6	*0*	Y =	-0.0482	+7.095E-10	+3.358E-08	-2.567E-11	0.0002
		Z =	-0.0203	-4.301E-10	-2.567E-11	+3.285E-08	0.0002
		X =	0.0549	+3.333E-08	+4.665E-10	-1.126E-09	0.0002
mrc8	*0*	Y =	-0.0238	+4.665E-10	+3.257E-08	-2.258E-10	0.0002
		Z =	0.0046	-1.126E-09	-2.258E-10	+3.268E-08	0.0002
		X =	0.2427	+1.416E-06	+5.186E-08	-4.416E-08	0.0012
rtc1		Y =	-0.2610	+5.186E-08	+1.498E-06	-8.627E-08	0.0012
		Z =	-0.2899	-4.416E-08	-8.627E-08	+1.364E-06	0.0012
		X =	0.2655	+1.645E-06	+3.787E-08	-3.115E-08	0.0013
rtc2		Y =	-0.2598	+3.787E-08	+1.731E-06	-1.063E-07	0.0013
		Z =	-0.3364	-3.115E-08	-1.063E-07	+1.546E-06	0.0012
		X =	0.2670	+1.540E-06	+2.198E-08	-2.060E-08	0.0012
rtc3		Y =	-0.2098	+2.198E-08	+1.645E-06	-1.063E-07	0.0013
		Z =	-0.3358	-2.060E-08	-1.063E-07	+1.414E-06	0.0012
		X =	0.2446	+1.311E-06	+3.896E-08	-3.290E-08	0.0011
rtc4		Y =	-0.2103	+3.896E-08	+1.410E-06	-8.941E-08	0.0012
		Z =	-0.2894	-3.290E-08	-8.941E-08	+1.233E-06	0.0011
		X =	0.2899	+1.776E-06	+9.493E-08	-1.403E-07	0.0013
rtc5		Y =	-0.2617	+9.493E-08	+1.698E-06	+3.421E-08	0.0013
		Z =	-0.2681	-1.403E-07	+3.421E-08	+1.822E-06	0.0013
		X =	0.3112	+2.191E-06	+5.082E-07	-5.069E-08	0.0015
rtc6		Y =	-0.2623	+5.082E-07	+2.333E-06	-1.647E-07	0.0015
		Z =	-0.3133	-5.069E-08	-1.647E-07	+1.855E-06	0.0014

	X =	0.2937	+1.629E-06	+2.014E-08	-1.823E-07	0.0013
rtc8	Y =	-0.2114	+2.014E-08	+1.537E-06	-1.577E-07	0.0012
	Z =	-0.2681	-1.823E-07	-1.577E-07	+1.532E-06	0.0012
	X =	0.0831	+5.635E-07	-4.894E-08	-9.703E-08	0.0008
ear1-l	Y =	0.1796	-4.894E-08	+5.613E-07	-7.388E-08	0.0007
	Z =	-0.0902	-9.703E-08	-7.388E-08	+5.144E-07	0.0007
	X =	0.0725	+5.881E-07	+1.725E-08	-1.153E-07	0.0008
ear1-r	Y =	-0.1730	+1.725E-08	+6.106E-07	+3.589E-08	0.0008
	Z =	-0.1123	-1.153E-07	+3.589E-08	+5.572E-07	0.0007
	X =	0.0752	+5.426E-07	-5.162E-08	-1.011E-07	0.0007
ear2-l	Y =	0.1590	-5.162E-08	+5.530E-07	-6.557E-08	0.0007
	Z =	-0.1026	-1.011E-07	-6.557E-08	+4.941E-07	0.0007

TRIANGULATED OBJECT POINTS

Ident	Position (meters)		Covariance Matrix			Std Dev (m)
	X =	0.0653	+5.642E-07	+1.285E-08	-1.145E-07	0.0008
ear2-r	Y =	-0.1502	+1.285E-08	+5.876E-07	+3.230E-08	0.0008
	Z =	-0.1212	-1.145E-07	+3.230E-08	+5.234E-07	0.0007
	X =	0.0683	+5.285E-07	-5.445E-08	-1.054E-07	0.0007
ear3-l	Y =	0.1377	-5.445E-08	+5.491E-07	-5.835E-08	0.0007
	Z =	-0.1152	-1.054E-07	-5.835E-08	+4.796E-07	0.0007
	X =	0.0572	+6.725E-07	+9.706E-08	-1.714E-07	0.0008
ear3-r	Y =	-0.1275	+9.706E-08	+6.311E-07	-1.327E-08	0.0008
	Z =	-0.1294	-1.714E-07	-1.327E-08	+6.013E-07	0.0008
	X =	0.0604	+5.196E-07	-5.673E-08	-1.099E-07	0.0007
ear4-l	Y =	0.1170	-5.673E-08	+5.487E-07	-5.244E-08	0.0007
	Z =	-0.1270	-1.099E-07	-5.244E-08	+4.706E-07	0.0007
	X =	0.0494	+6.671E-07	+9.644E-08	-1.787E-07	0.0008
ear4-r	Y =	-0.1045	+9.644E-08	+6.230E-07	-1.771E-08	0.0008
	Z =	-0.1384	-1.787E-07	-1.771E-08	+5.885E-07	0.0008
	X =	0.4191	+3.957E-05	-4.091E-06	-4.325E-05	0.0063
* g	Y =	-0.3568	-4.091E-06	+1.175E-05	+4.562E-06	0.0034
	Z =	-1.2174	-4.325E-05	+4.562E-06	+7.604E-05	0.0087
	X =	0.4381	+4.878E-05	+2.010E-05	-5.626E-05	0.0070
* h	Y =	0.5933	+2.010E-05	+2.442E-05	-3.105E-05	0.0049
	Z =	-1.2110	-5.626E-05	-3.105E-05	+9.616E-05	0.0098

SUMMARY STATISTICS FOR OBJECT POINTS

RMS For Standard Deviations

Count =	37	X =	0.0021 meters
Count =	37	Y =	0.0017 meters

Count = 37 Z = 0.0026 meters

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

	X =	0.0000 m		X =	0.0000 m
mcc1	Y =	0.0000 m	mlc1	Y =	0.0001 m
	Z =	0.0001 m		Z =	0.0000 m
	X =	0.0000 m		X =	0.0000 m
mrc1	Y =	0.0001 m	mcc2	Y =	-0.0001 m
	Z =	-0.0001 m		Z =	0.0003 m
	X =	0.0000 m		X =	0.0001 m
mlc2	Y =	0.0000 m	mrc2	Y =	0.0000 m
	Z =	0.0000 m		Z =	-0.0001 m
	X =	0.0001 m		X =	0.0000 m
mcc3	Y =	-0.0001 m	mlc3	Y =	0.0000 m
	Z =	0.0002 m		Z =	-0.0001 m
	X =	0.0000 m		X =	0.0000 m
mrc3	Y =	0.0000 m	mcc4	Y =	-0.0001 m
	Z =	0.0000 m		Z =	0.0000 m
	X =	-0.0001 m		X =	0.0000 m
mlc4	Y =	0.0000 m	mrc4	Y =	0.0000 m
	Z =	-0.0002 m		Z =	-0.0001 m
	X =	-0.0001 m		X =	0.0000 m
mcc5	Y =	0.0000 m	mlc5	Y =	0.0001 m
	Z =	0.0001 m		Z =	-0.0001 m
	X =	0.0000 m		X =	0.0000 m
mrc5	Y =	0.0000 m	mcc6	Y =	0.0000 m
	Z =	-0.0001 m		Z =	0.0000 m
	X =	0.0000 m		X =	0.0000 m
mrc6	Y =	0.0000 m	mcc7	Y =	-0.0001 m
	Z =	0.0000 m		Z =	0.0001 m
	X =	0.0000 m		X =	0.0000 m
mlc7	Y =	0.0001 m	mcc8	Y =	-0.0001 m
	Z =	-0.0001 m		Z =	0.0000 m
	X =	0.0000 m		X =	0.0000 m
mlc8	Y =	0.0000 m	mrc8	Y =	0.0000 m
	Z =	-0.0001 m		Z =	0.0001 m

X .... Number of Components =	22	RMS =	0.0000 meters
Y .... Number of Components =	22	RMS =	0.0001 meters
Z .... Number of Components =	22	RMS =	0.0001 meters

35mm Still Camera System for Head Anthropometry of HRV # = 0253

A N T H R O P O M E T R Y O U T P U T

T-PLATE ORIGIN WITH RESPECT TO HEAD ANATOMICAL ORIGIN

X= 15.7009cm Y= -0.1695cm Z= -5.4439cm

T-PLATE ORIENTATION WITH RESPECT TO HEAD ANATOMICAL SYSTEM

-0.508605	0.082581	-0.857030
-0.007191	0.994948	0.100138
0.860970	0.057093	-0.505442

Body Anthropometry Output File

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X-Ray Determination of Body Anthropometry of HRV # = 0253

Object Space Reference System is Rectangular

Rotation angles are Terrestrial Object-to-Photo

Complete Triangulation process is requested

Error Propagation is requested

[Eigenvector/Eigenvalue output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will be saved

Adjusted Camera Station Parameters will be saved

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X-Ray Determination of Body Anthropometry of HRV # = 0253

E R R O R W A R N I N G S

PASS POINTS APPEARING ON 1 PHOTO

*Rib_Rt	*r2	*r3	*r4
*r6	*c7	*c8	

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X-Ray Determination of Body Anthropometry of HRV # = 0253

C A M E R A S T A T I O N S C O R R E C T I O N S

	------- P O S I T I O N -------			--------- A T T I T U D E ------		
	X	Y	Z	Azim.	Elev.	Swing
			Iteration 1			
LfEyLfSh	0.0025	0.0026	0.0043 m.	0.005165	-0.008976	0.009395
RtEyLfSh	0.0048	0.0016	-0.0042 m.	0.006387	0.007221	-0.004892
LfEyRtSh	-0.0002	0.0003	-0.0015 m.	-0.000130	-0.002379	0.007539
RtEyRtSh	-0.0007	0.0005	-0.0014 m.	-0.000203	-0.002936	0.006722

Provisional Weighted Sum of Squares = 2007.91

Iteration 2

LfEyLfSh	-0.0002	-0.0001	0.0001 m.	-0.000245	-0.000300	0.000168
RtEyLfSh	-0.0001	0.0000	0.0000 m.	-0.000042	0.000029	-0.000182
LfEyRtSh	0.0000	-0.0001	0.0000 m.	0.000029	0.000073	0.000043
RtEyRtSh	0.0000	-0.0001	0.0000 m.	0.000008	0.000065	0.000017

Provisional Weighted Sum of Squares = 1953.95

Iteration 3

LfEyLfSh	0.0000	0.0000	0.0000 m.	0.000005	-0.000019	0.000019
RtEyLfSh	0.0000	0.0000	0.0000 m.	0.000006	0.000010	0.000010
LfEyRtSh	0.0000	0.0000	0.0000 m.	0.000000	-0.000004	0.000012
RtEyRtSh	0.0000	0.0000	0.0000 m.	0.000002	-0.000008	0.000009

Provisional Weighted Sum of Squares = 1953.89

X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

Origin	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	-840	738	1457	-1651
	-6245	1065	3951	1370
Rib_Lf	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	-2922	2985	-754	620
	-319	5515	-3151	-1763
SpineTop	RtEyLfSh	LfEyRtSh	LfEyLfSh	RtEyRtSh
	-2434	-4097	2648	4163
	-2796	2288	-2641	3347
SpineBot	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	1913	-1851	-921	999
	-2159	-2338	2259	2391
spine_bb	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	174	-139	470	-300
	2020	2154	-2039	-2198
sternum	RtEyLfSh	LfEyLfSh	LfEyRtSh	RtEyRtSh
	-952	-135	223	-1040
	5370	3514	-4608	-4657
*lf_shol	RtEyLfSh	LfEyLfSh		
	-31	29		
	-217	216		
lneckT	RtEyLfSh	LfEyLfSh	RtEyRtSh	
	943	-987	-121	
	-1336	325	794	
lneckB	LfEyLfSh	RtEyLfSh	RtEyRtSh	
	-776	794	-48	
	411	-717	237	

```
   rneckT       LfEyLfSh LfEyRtSh RtEyRtSh
                    -180     1000    -1227
                   -2664     1930     1367

   rneckB       LfEyRtSh LfEyLfSh RtEyRtSh
                    1200       80    -1126
                    2650    -3863     2151

      *r1       RtEyLfSh LfEyLfSh
                     -10        9
                     -85       84

       r2 *0*   LfEyLfSh LfEyRtSh RtEyRtSh
                   -6040     1492     3314
                    4211    -4083    -3908
```



```
    T R I A N G U L A T E D   I M A G E   P O I N T S   R E S I D U A L S
                          (in micrometers)

       r3 *0*   LfEyRtSh LfEyLfSh RtEyRtSh
                    -141     6566     -412
                   -1718     -607    -1227

       r4 *0*   LfEyLfSh LfEyRtSh RtEyRtSh
                    5828     1243     1229
                   -3163     -132       94

      *r5       RtEyLfSh LfEyLfSh
                     -36       33
                    -293      290

       r6 *0*   LfEyRtSh LfEyLfSh RtEyRtSh
                     899    -8332       67
                   -2349     7127    -1180

       r7 *0*   LfEyLfSh RtEyLfSh LfEyRtSh RtEyRtSh
                    2531     3209     1158    -1612
                    1654     1369      579     1199

       r8 *0*   LfEyLfSh LfEyRtSh RtEyLfSh RtEyRtSh
                    1955      -73     2169    -2293
                    1003     2184      221     2579

       c1 *0*   LfEyRtSh LfEyLfSh RtEyLfSh RtEyRtSh
                   -2802    -2426    -1398     -165
                   -2144     1603     1046    -2066

       c2 *0*   RtEyLfSh LfEyLfSh LfEyRtSh RtEyRtSh
                   -1015    -1625    -2410      109
                    2833     2865    -1614    -1213

      *c3       LfEyLfSh RtEyLfSh
                      -1        1
```

```
                -10        10

   *c4       LfEyLfSh  RtEyLfSh
                   3        -3
                  27       -27

   *c5       LfEyLfSh  RtEyLfSh
                  23       -25
                 202      -203

   *c6       RtEyLfSh  LfEyLfSh
                 -20        19
                -164       163

    c7 *0*   LfEyRtSh  LfEyLfSh  RtEyRtSh
                1549      5266       -11
                3414     -3835      3369
```


T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

```
    c8 *0*   LfEyLfSh  LfEyRtSh  RtEyRtSh
                6351      2252       565
               -7500      5856      5982

   11 *0*   LfEyRtSh  RtEyLfSh  LfEyLfSh  RtEyRtSh
               -1957     -1100     -1993       516
               -4701      1073      2110     -4981

   12 *0*   LfEyRtSh  LfEyLfSh  RtEyLfSh  RtEyRtSh
               -2089      -830        27      -126
               -3692      1429       631     -4595

   13 *0*   LfEyRtSh  RtEyLfSh  LfEyLfSh  RtEyRtSh
                -248      1449     -2019      -715
                -941     -3248     -2267     -1762

   14 *0*   LfEyRtSh  LfEyLfSh  RtEyLfSh  RtEyRtSh
                2224     -2825      1123      2073
                 897     -2620     -3827       486

   15 *0*   LfEyLfSh  RtEyLfSh  LfEyRtSh  RtEyRtSh
                 913     -1416     -1608     -1891
                4948      4235     -1051     -1803

   16 *0*   RtEyLfSh  LfEyRtSh  LfEyLfSh  RtEyRtSh
               -2065       785       151      -353
                2762     -1693      3150     -2085

   17 *0*   LfEyLfSh  LfEyRtSh  RtEyLfSh  RtEyRtSh
               -2795      2695     -1900      -616
                 158      1626      -687       881
```

18 *0*	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	408	1124	1872	-953
	210	-649	3968	4023

Rib_Rt	RtEyRtSh	LfEyRtSh	RtEyLfSh
	175	-565	-71
	6806	5845	-11729

*rt_shol	RtEyRtSh	LfEyRtSh
	13	-14
	-311	311

r1 *0*	LfEyRtSh	RtEyRtSh
	-109	2134
	-4870	-4113

r5 *0*	LfEyRtSh	RtEyRtSh
	-259	-301
	-1964	-1193

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S

(in micrometers)

c3 *0*	RtEyRtSh	LfEyRtSh
	-923	-1148
	-1887	-1463

c4 *0*	RtEyRtSh	LfEyRtSh
	1345	926
	2300	2868

c5 *0*	RtEyRtSh	LfEyRtSh
	-477	-1181
	1753	1660

c6 *0*	LfEyRtSh	RtEyRtSh
	-1104	-900
	32	-46

Weighted Sum of Squares (Camera)	=	2.2
Weighted Sum of Squares (Object)	=	118.5
Weighted Sum of Squares (Plates)	=	1684.7
Weighted Sum of Squares (Total)	=	1805.4
Degrees of Freedom.....	=	185

a posteriori Variance of Unit Weight = 9.759

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D C A M E R A S T A T I O N S
(Terrestrial->Ph)

Ident	Position		Error Ellipsoid			--->	Length
LfEyLfSh	X =	0.5084 m.	+0.7931	+0.6089	-0.0123	--->	0.0100 m.
	Y =	-0.4485 m.	-0.4864	+0.6211	-0.6146	--->	0.0079 m.
	Z =	-0.0755 m.	+0.3666	-0.4934	-0.7888	--->	0.0071 m.
	Azim. =	315 02 6.4341					00 51 22.2323
	Attitude: Elev. =	-00 33 32.6112	Std Dev:				00 51 22.2323
	Swing =	00 27 5.6771					00 52 48.4597
RtEyLfSh	X =	0.5527 m.	+0.4902	+0.8711	-0.0279	--->	0.0111 m.
	Y =	-0.4114 m.	+0.8186	-0.4492	+0.3578	--->	0.0090 m.
	Z =	-0.0822 m.	-0.2991	+0.1983	+0.9334	--->	0.0076 m.
	Azim. =	314 45 41.7829					00 56 14.3432
	Attitude: Elev. =	00 01 9.6575	Std Dev:				00 56 14.3432
	Swing =	01 01 21.4765					00 56 3.6139
LfEyRtSh	X =	0.5147 m.	-0.7583	+0.6506	+0.0412	--->	0.0083 m.
	Y =	0.4702 m.	-0.6488	-0.7470	-0.1452	--->	0.0073 m.
	Z =	-0.0695 m.	+0.0636	+0.1369	-0.9885	--->	0.0070 m.
	Azim. =	222 37 35.9298					00 42 11.5625
	Attitude: Elev. =	-01 24 18.3679	Std Dev:				00 42 11.5625
	Swing =	-01 14 38.0329					00 48 16.2198
RtEyRtSh	X =	0.4822 m.	+0.7947	-0.6049	-0.0513	--->	0.0084 m.
	Y =	0.4995 m.	-0.5811	-0.7336	-0.3523	--->	0.0072 m.
	Z =	-0.0684 m.	-0.1754	-0.3098	+0.9345	--->	0.0069 m.
	Azim. =	222 18 17.0390					00 42 31.7849
	Attitude: Elev. =	-01 31 6.6971	Std Dev:				00 42 31.7849
	Swing =	-01 03 31.7206					00 46 42.5383

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

Count = 4	X =	0.0087 m.	Azim. =	00 48 27.1792
	Y =	0.0087 m.	Elev. =	00 52 32.7915
	Z =	0.0073 m.	Swing =	00 51 5.7522

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)		Error Ellipsoid --->			Length (m)
	X =	-0.0307	+9.815E-01	+1.433E-01	-1.268E-01	0.0007

c1	*0*	Y =	-0.0069	-1.418E-01	+9.897E-01	+2.034E-02	0.0007
		Z =	0.0019	+1.284E-01	-1.986E-03	+9.917E-01	0.0007
		X =	-0.0307	-9.866E-01	-1.380E-01	+8.723E-02	0.0007
c2	*0*	Y =	-0.0066	+1.367E-01	-9.904E-01	-2.103E-02	0.0007
		Z =	-0.0189	+8.930E-02	-8.821E-03	+9.960E-01	0.0007
		X =	-0.0308	-7.457E-01	-6.631E-01	+6.500E-02	0.0008
c3	*0*	Y =	0.0144	+6.000E-01	-6.259E-01	+4.983E-01	0.0007
		Z =	-0.0226	+2.897E-01	-4.106E-01	-8.646E-01	0.0007
		X =	-0.0309	-7.446E-01	-6.598E-01	+1.007E-01	0.0008
c4	*0*	Y =	0.0156	-6.509E-01	+6.845E-01	-3.284E-01	0.0007
		Z =	0.0022	-1.478E-01	+3.101E-01	+9.392E-01	0.0007
		X =	-0.0082	-7.134E-01	-6.935E-01	+1.008E-01	0.0008
c5	*0*	Y =	-0.0075	-6.982E-01	+6.912E-01	-1.866E-01	0.0007
		Z =	0.0023	-5.974E-02	+2.034E-01	+9.773E-01	0.0007
		X =	-0.0085	-7.147E-01	-6.960E-01	+6.915E-02	0.0008
c6	*0*	Y =	-0.0087	-6.824E-01	+6.721E-01	-2.874E-01	0.0007
		Z =	-0.0199	-1.536E-01	+2.526E-01	+9.553E-01	0.0007
		X =	-0.0081	+7.933E-01	+6.045E-01	-7.227E-02	0.0008
c7	*0*	Y =	0.0151	-6.025E-01	+7.966E-01	+4.928E-02	0.0007
		Z =	-0.0208	+8.736E-02	+4.449E-03	+9.962E-01	0.0007
		X =	-0.0078	+7.914E-01	+6.014E-01	-1.096E-01	0.0008
c8	*0*	Y =	0.0158	-5.978E-01	+7.988E-01	+6.757E-02	0.0007
		Z =	0.0018	+1.282E-01	+1.207E-02	+9.917E-01	0.0007
		X =	0.0306	+9.205E-01	+3.652E-01	-1.392E-01	0.0007
l1	*0*	Y =	0.0334	-3.617E-01	+9.309E-01	+5.044E-02	0.0007
		Z =	0.0037	+1.480E-01	+3.909E-03	+9.890E-01	0.0007
		X =	0.0307	-9.164E-01	-3.895E-01	+9.202E-02	0.0007
l2	*0*	Y =	0.0340	+3.867E-01	-9.210E-01	-4.744E-02	0.0007
		Z =	-0.0197	+1.032E-01	-7.892E-03	+9.946E-01	0.0007
		X =	0.0311	+8.569E-01	+5.083E-01	-8.555E-02	0.0007
l3	*0*	Y =	0.0551	-5.050E-01	+8.612E-01	+5.842E-02	0.0007
		Z =	-0.0200	+1.034E-01	-6.863E-03	+9.946E-01	0.0007
		X =	0.0306	+8.619E-01	+4.889E-01	-1.347E-01	0.0007
l4	*0*	Y =	0.0562	-4.850E-01	+8.723E-01	+6.224E-02	0.0007
		Z =	0.0037	+1.479E-01	+1.169E-02	+9.889E-01	0.0007
		X =	0.0536	+8.464E-01	+5.146E-01	-1.370E-01	0.0007
l5	*0*	Y =	0.0343	-5.088E-01	+8.574E-01	+7.728E-02	0.0007
		Z =	0.0027	+1.572E-01	+4.270E-03	+9.876E-01	0.0007

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Error Ellipsoid --->			Length (m)
	X =	0.0527	-8.176E-01	-5.692E-01	+8.745E-02		0.0007
16	*0* Y =	0.0341	+5.649E-01	-8.222E-01	-7.000E-02		0.0007
	Z =	-0.0202	+1.117E-01	-7.829E-03	+9.937E-01		0.0007
	X =	0.0520	+7.662E-01	+6.372E-01	-8.251E-02		0.0007
17	*0* Y =	0.0556	-6.326E-01	+7.707E-01	+7.658E-02		0.0007
	Z =	-0.0208	+1.124E-01	-6.481E-03	+9.936E-01		0.0007
	X =	0.0538	+7.851E-01	+6.047E-01	-1.338E-01		0.0007
18	*0* Y =	0.0559	-5.988E-01	+7.963E-01	+8.560E-02		0.0007
	Z =	0.0025	+1.583E-01	+1.293E-02	+9.873E-01		0.0007
	X =	0.0327	-6.557E-01	-7.481E-01	+1.021E-01		0.0008
r1	*0* Y =	-0.0468	-7.515E-01	+6.335E-01	-1.842E-01		0.0007
	Z =	0.0042	-7.314E-02	+1.975E-01	+9.776E-01		0.0007
	X =	0.0315	+6.709E-01	+7.389E-01	-6.259E-02		0.0007
r2	*0* Y =	-0.0458	-7.341E-01	+6.737E-01	+8.462E-02		0.0007
	Z =	-0.0217	+1.047E-01	-1.082E-02	+9.944E-01		0.0007
	X =	0.0305	+6.905E-01	+7.203E-01	-6.608E-02		0.0007
r3	*0* Y =	-0.0245	-7.160E-01	+6.936E-01	+7.874E-02		0.0007
	Z =	-0.0215	+1.025E-01	-7.056E-03	+9.947E-01		0.0007
	X =	0.0313	+6.926E-01	+7.141E-01	-1.023E-01		0.0007
r4	*0* Y =	-0.0247	-7.048E-01	+7.000E-01	+1.148E-01		0.0007
	Z =	0.0031	+1.535E-01	-7.394E-03	+9.881E-01		0.0007
	X =	0.0523	-6.400E-01	-7.614E-01	+1.033E-01		0.0008
r5	*0* Y =	-0.0460	+6.379E-01	-4.515E-01	+6.238E-01		0.0007
	Z =	0.0033	+4.284E-01	-4.651E-01	-7.747E-01		0.0007
	X =	0.0526	+6.057E-01	+7.935E-01	-6.004E-02		0.0007
r6	*0* Y =	-0.0461	-7.879E-01	+6.085E-01	+9.457E-02		0.0007
	Z =	-0.0223	+1.116E-01	-9.970E-03	+9.937E-01		0.0007
	X =	0.0522	-9.906E-01	+7.748E-02	+1.127E-01		0.0007
r7	*0* Y =	-0.0235	+7.886E-02	+9.969E-01	+7.844E-03		0.0007
	Z =	-0.0220	-1.118E-01	+1.666E-02	-9.936E-01		0.0007
	X =	0.0528	-9.820E-01	-1.066E-01	+1.562E-01		0.0007
r8	*0* Y =	-0.0245	+1.016E-01	-9.940E-01	-3.942E-02		0.0007
	Z =	0.0028	+1.595E-01	-2.283E-02	+9.869E-01		0.0007
	X =	0.0303	-7.906E-01	+6.058E-01	+8.898E-02		0.0392
*c3	Y =	-0.0491	+6.104E-01	+7.913E-01	+3.602E-02		0.0019
	Z =	-0.0228	+4.859E-02	-8.279E-02	+9.954E-01		0.0018
	X =	0.0359	-7.857E-01	+6.052E-01	+1.277E-01		0.0393
*c4	Y =	-0.0518	-6.130E-01	-7.344E-01	-2.913E-01		0.0019
	Z =	0.0012	+8.251E-02	+3.072E-01	-9.481E-01		0.0018

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)		Error Ellipsoid --->			Length (m)
	X =	-0.0211	-7.770E-01	+6.196E-01	+1.111E-01	0.0479
*c5	Y =	0.0089	-6.295E-01	-7.632E-01	-1.461E-01	0.0020
	Z =	-0.0001	+5.686E-03	+1.835E-01	-9.830E-01	0.0020
	X =	-0.0241	-7.790E-01	+6.216E-01	+8.169E-02	0.0481
*c6	Y =	0.0117	-6.246E-01	-7.581E-01	-1.877E-01	0.0020
	Z =	-0.0208	+5.477E-02	+1.973E-01	-9.788E-01	0.0020
	X =	-0.0025	-7.803E-01	+6.146E-01	+1.157E-01	0.0444
*r1	Y =	-0.0116	-5.988E-01	-6.808E-01	-4.220E-01	0.0019
	Z =	0.0000	+1.806E-01	+3.986E-01	-8.992E-01	0.0019
	X =	-0.0043	-7.650E-01	+6.340E-01	+1.133E-01	0.0461
*r5	Y =	0.0123	-6.436E-01	-7.455E-01	-1.734E-01	0.0019
	Z =	0.0002	+2.548E-02	+2.056E-01	-9.783E-01	0.0019
	X =	0.1667	+1.696E-01	+9.855E-01	+9.441E-03	0.0027
Origin	Y =	0.0054	-9.854E-01	+1.694E-01	+1.891E-02	0.0022
	Z =	-0.0751	+1.704E-02	-1.251E-02	+9.998E-01	0.0017
	X =	0.1409	+1.751E-01	+9.844E-01	+1.807E-02	0.0024
Rib_Lf	Y =	0.0370	-9.845E-01	+1.748E-01	+1.329E-02	0.0021
	Z =	-0.0784	+9.927E-03	-2.012E-02	+9.997E-01	0.0016
	X =	0.1447	+4.646E-01	+8.855E-01	+2.799E-03	0.0030
Rib_Rt	Y =	-0.0192	+8.855E-01	-4.646E-01	+1.504E-03	0.0022
	Z =	-0.0759	+2.633E-03	+1.780E-03	-1.000E+00	0.0018
	X =	-0.0451	+9.969E-01	-5.515E-02	+5.554E-02	0.0032
lneckB	Y =	0.1152	+5.130E-02	+9.963E-01	+6.852E-02	0.0027
	Z =	-0.0984	-5.912E-02	-6.546E-02	+9.961E-01	0.0021
	X =	-0.0458	-9.968E-01	+5.720E-02	+5.556E-02	0.0031
lneckT	Y =	0.1179	-5.829E-02	-9.981E-01	-1.821E-02	0.0026
	Z =	-0.0348	+5.442E-02	-2.139E-02	+9.983E-01	0.0020
	X =	-0.0397	+9.019E-01	+4.276E-01	+6.137E-02	0.0031
rneckB	Y =	-0.0949	-4.259E-01	+9.039E-01	-3.969E-02	0.0025
	Z =	-0.1014	-7.244E-02	+9.657E-03	+9.973E-01	0.0021
	X =	-0.0396	+8.963E-01	+4.410E-01	-4.694E-02	0.0030
rneckT	Y =	-0.0943	-4.399E-01	+8.975E-01	+3.257E-02	0.0024
	Z =	-0.0381	+5.649E-02	-8.540E-03	+9.984E-01	0.0019
	X =	0.1819	-1.622E-01	-9.866E-01	-1.854E-02	0.0031
sternum	Y =	-0.0004	-9.776E-01	+1.632E-01	-1.328E-01	0.0025
	Z =	-0.1312	-1.340E-01	+3.408E-03	+9.910E-01	0.0020
	X =	-0.0256	+6.997E-01	-7.054E-01	+1.127E-01	0.0690
*lf_shol	Y =	0.1266	-6.911E-01	-7.084E-01	-1.432E-01	0.0032
	Z =	-0.1676	-1.809E-01	-2.232E-02	+9.832E-01	0.0030

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)		Error Ellipsoid --->			Length (m)
	X =	-0.0638	+6.507E-01	+7.482E-01	+1.297E-01	0.1109
*rt_shol	Y =	-0.1608	-7.291E-01	+6.633E-01	-1.684E-01	0.0034
	Z =	-0.1809	+2.120E-01	-1.502E-02	-9.771E-01	0.0033
	X =	0.0915	+1.834E-01	+9.830E-01	+6.529E-03	0.0021
SpineBot	Y =	-0.0002	+9.830E-01	-1.833E-01	-6.239E-03	0.0020
	Z =	-0.0771	-4.936E-03	+7.563E-03	-1.000E+00	0.0015
	X =	0.0974	+1.730E-01	+9.849E-01	+4.707E-03	0.0021
SpineTop	Y =	-0.0016	-9.847E-01	+1.729E-01	+2.196E-02	0.0020
	Z =	-0.0703	-2.082E-02	+8.434E-03	-9.997E-01	0.0015
	X =	0.0591	+6.670E-01	+7.450E-01	-2.066E-03	0.0019
spine_bb	Y =	0.0043	-7.448E-01	+6.669E-01	+2.026E-02	0.0019
	Z =	-0.0683	-1.647E-02	+1.198E-02	-9.998E-01	0.0014

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

Count =	19	X =	0.0279 meters
Count =	19	Y =	0.0270 meters
Count =	19	Z =	0.0050 meters

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X-Ray Determination of Body Anthropometry of HRV # = 0253

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

	X =	0.0000 m		X =	0.0001 m
c1	Y =	0.0004 m	l1	Y =	0.0004 m
	Z =	0.0001 m		Z =	0.0005 m
	X =	0.0002 m		X =	0.0000 m
r1	Y =	0.0000 m	c2	Y =	0.0003 m
	Z =	0.0007 m		Z =	-0.0002 m
	X =	-0.0001 m		X =	0.0006 m
l2	Y =	0.0002 m	r2	Y =	0.0002 m
	Z =	0.0005 m		Z =	0.0002 m
	X =	-0.0001 m		X =	0.0000 m
c3	Y =	0.0001 m	l3	Y =	0.0001 m
	Z =	0.0002 m		Z =	0.0006 m
	X =	-0.0004 m		X =	0.0001 m
r3	Y =	-0.0004 m	c4	Y =	-0.0002 m
	Z =	0.0003 m		Z =	-0.0004 m

	X =	0.0004 m		X =	-0.0002 m
14	Y =	-0.0002 m	r4	Y =	-0.0005 m
	Z =	0.0004 m		Z =	0.0003 m
	X =	-0.0001 m		X =	-0.0002 m
c5	Y =	0.0001 m	15	Y =	0.0003 m
	Z =	-0.0003 m		Z =	-0.0005 m
	X =	0.0000 m		X =	-0.0001 m
r5	Y =	0.0000 m	c6	Y =	0.0001 m
	Z =	0.0002 m		Z =	0.0000 m
	X =	0.0001 m		X =	0.0005 m
16	Y =	0.0001 m	r6	Y =	0.0006 m
	Z =	-0.0001 m		Z =	-0.0003 m
	X =	-0.0002 m		X =	0.0004 m
c7	Y =	-0.0004 m	17	Y =	0.0001 m
	Z =	-0.0002 m		Z =	-0.0002 m
	X =	-0.0004 m		X =	-0.0002 m
r7	Y =	-0.0003 m	c8	Y =	-0.0006 m
	Z =	-0.0004 m		Z =	-0.0003 m
	X =	-0.0001 m		X =	-0.0004 m
18	Y =	-0.0002 m	r8	Y =	-0.0002 m
	Z =	-0.0007 m		Z =	-0.0005 m

X .... Number of Components =	24	RMS =	0.0003	meters
Y .... Number of Components =	24	RMS =	0.0003	meters
Z .... Number of Components =	24	RMS =	0.0004	meters

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X-Ray Determination of Body Anthropometry of HRV # = 0253

A N T H R O P O M E T R Y O U T P U T

T-PLATE ORIGIN WITH RESPECT TO BODY ANATOMICAL ORIGIN

X= -16.8052cm Y= 0.6003cm Z= 7.2123cm

T-PLATE ORIENTATION WITH RESPECT TO BODY ANATOMICAL SYSTEM

0.995966	-0.088285	0.016067
0.087475	0.995123	0.045594
-0.020014	-0.044004	0.998831

Site Survey Output File

```
NBDL GIANT: 15:15   03/25/92                                    Page  1
 azimuth - elevation - swing

                Object Space Reference System is Rectangular

                Rotation angles are Terrestrial Object-to-Photo

                Complete Triangulation process is requested

                      Error Propagation is requested

                        [Variance/Covariance output]

          Unit Variance will be based on completely free camera parameters

                      All Image Residuals will be listed

                Triangulated Object Coordinates will not be saved

                Adjusted Camera Station Parameters will be saved


NBDL GIANT: 15:15   03/25/92                                    Page  2
 azimuth - elevation - swing

                           E R R O R    W A R N I N G S


                             POINTS NOT PHOTOGRAPHED

                      rtc5


                        PASS POINTS APPEARING ON 1 PHOTO

                        xc6          xc        xx+24          c6
                      xz+12       yx+24        Xy-06       Xlfc4
                       lfc7
```

NBDL GIANT: 15:15 03/25/92 Page 3
azimuth - elevation - swing

	CAMERA STATIONS CORRECTIONS					
	POSITION			ATTITUDE		
	X	Y	Z	Azim.	Elev.	Swing
			Iteration 1			
#1	-0.0002	-0.0001	0.0002 m.	-0.000049	-0.000150	0.000101
#2	0.0001	-0.0003	0.0006 m.	-0.000029	-0.000243	0.000189
#3	-0.0005	0.0001	0.0001 m.	-0.000198	-0.000117	0.000093
#4	-0.0003	0.0000	0.0003 m.	-0.000156	0.000571	-0.000648
#5	-0.0006	0.0005	0.0001 m.	-0.000106	0.000123	-0.000365
#6	-0.0006	0.0000	0.0002 m.	-0.000126	-0.000143	-0.000197

Provisional Weighted Sum of Squares = 679.576

			Iteration 2			
#1	0.0000	0.0000	0.0000 m.	-0.000001	0.000000	-0.000002
#2	0.0000	0.0000	0.0000 m.	-0.000004	0.000001	0.000001
#3	0.0000	0.0000	0.0000 m.	-0.000002	-0.000003	0.000003
#4	0.0000	0.0000	0.0000 m.	-0.000001	-0.000002	0.000001
#5	0.0000	0.0000	0.0000 m.	0.000001	-0.000002	0.000002
#6	0.0000	0.0000	0.0000 m.	0.000003	-0.000001	0.000001

Provisional Weighted Sum of Squares = 625.981

			Iteration 3			
#1	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000
#2	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000
#3	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000
#4	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000
#5	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000
#6	0.0000	0.0000	0.0000 m.	0.000000	0.000000	0.000000

Provisional Weighted Sum of Squares = 625.954

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azimuth - elevation - swing

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

lfc1	#1	#2	#3	#4	#5	#6
	0	8	-15	-6	12	-17
	-1	-12	9	9	4	-8

lfc3	#1	#2	#3	#4	#5	#6
	17	2	-5	-9	27	-4
	8	-11	-11	1	0	6

lfc4	#2	#1	#3	#4	#5
	1	6	-6	6	3
	-4	2	-4	0	4

lfc6	#3	#1	#6			
	-22	14	-3			
	9	15	-16			
c1	#2	#3	#4	#1	#5	#6
	2	12	3	-7	0	0
	-13	-2	-4	-5	15	4
c2	#2	#4	#5	#1	#6	
	21	-3	4	-1	7	
	-3	1	9	-6	-3	
c3	#1	#2	#3	#4	#5	#6
	-6	12	14	0	-1	14
	-1	-2	-10	-6	5	9
c4	#2	#1	#3	#4	#5	#6
	10	-13	17	0	-15	15
	-3	-5	9	0	-4	4
c5	#1	#3	#2	#4	#5	
	-3	1	0	-1	0	
	1	-6	4	-6	6	
c7	#4	#1	#5	#6		
	5	18	3	0		
	9	-11	17	-15		
a	#2	#3	#4	#5	#1	
	22	-22	9	6	-21	
	-10	-26	-3	25	21	
b	#2	#3	#1	#4	#5	
	32	-27	-26	4	12	
	-6	-33	20	8	16	
rtc1 *0*	#1	#3	#4	#2	#5	
	4	-23	4	4	-7	
	-8	-9	1	0	-10	

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azimuth - elevation - swing

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

rtc2 *0*	#3	#2	#1	#6
	-11	-16	2	4
	32	19	-21	12
rtc3 *0*	#4	#1	#5	#6
	8	-3	-7	19
	-5	19	-8	-2
rtc6 *0*	#1	#2		
	-15	-30		

	7	19				
rtc7 *0*	#1					
	-36					
	-34					
sp1 *0*	#3	#4	#5	#1	#2	#6
	0	0	-9	0	-15	-16
	4	-11	-9	-6	-10	0
sp2 *0*	#4	#2	#5	#1	#3	#6
	-3	-20	-21	8	6	0
	-13	13	-15	-16	2	14
sp3 *0*	#2	#3	#4	#5	#1	#6
	-16	9	1	-14	2	-2
	10	-2	-4	-8	0	0
sp4 *0*	#1	#2	#4	#3	#5	#6
	15	3	8	0	-12	-5
	-7	5	-12	13	-13	-2
x+12 *0*	#4	#1	#5	#2	#3	#6
	-1	24	29	48	10	-9
	-18	15	-12	-28	-13	1
x+18 *0*	#4	#1	#2	#5	#3	#6
	-21	-4	19	30	17	-11
	-6	9	2	0	-19	0
y+12 *0*	#4	#1	#3	#5	#2	#6
	8	-7	10	-6	12	-3
	-1	-9	-4	7	-3	-38
y+06 *0*	#3	#4	#1	#5	#2	#6
	27	5	10	5	10	5
	-13	15	-10	0	0	-1
y-06 *0*	#1	#2	#4	#6		
	-5	-19	-4	0		
	-6	-20	14	1		

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azimuth - elevation - swing

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

z+06 *0*	#3	#5	#1	#2	#4	#6
	8	-31	12	-4	-3	-4
	18	3	7	-14	21	33
z+12 *0*	#2	#1	#4	#6		
	-17	17	-23	-19		
	-21	25	3	38		

lfc2	#3	#5	#6	#2	#4
	-2	4	-2	23	-14
	-2	27	-30	-2	12
lfc5	#3	#5	#4	#2	
	5	2	-7	-1	
	-1	-7	8	1	
c8	#4	#2	#6	#3	#5
	-1	0	13	15	-10
	1	-3	0	5	-2
d	#4	#6	#3	#5	#2
	5	2	0	-27	-35
	-19	6	22	-18	15
e	#2	#3	#6	#5	#4
	-36	-4	3	-11	6
	25	0	37	-41	-15
rtc4 *0*	#5	#3	#2	#6	#4
	-11	5	0	2	7
	-12	-1	21	-3	-15
rtc8 *0*	#2				
	5				
	20				
x+06 *0*	#5	#3	#2	#4	#6
	-14	13	10	-16	-15
	-9	-14	-9	-19	0
x+24 *0*	#3	#6	#2	#4	
	-14	48	-33	24	
	40	0	23	41	
lfc8	#3	#6	#5		
	-17	-10	3		
	10	0	-7		
c	#5	#6	#4		
	17	-4	-1		
	9	12	-18		

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azimuth - elevation - swing

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

y-12 *0*	#4	#6	#5
	9	-1	42
	32	-25	-6
g	#6	#5	
	-2	-2	

	-16	16
h	#6	#5
	-2	-2
	-19	17
i	#6	#5
	0	0
	-3	3

Weighted Sum of Squares (Camera) =	0.0
Weighted Sum of Squares (Object) =	107.0
Weighted Sum of Squares (Plates) =	206.4
Weighted Sum of Squares (Total) =	313.5
Degrees of Freedom..... =	286

a posteriori Variance of Unit Weight = 1.096

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azimuth - elevation - swing

T R I A N G U L A T E D C A M E R A S T A T I O N S
(Terrestrial->Ph)

Ident	Position/Attitude		Covariance Matrix		
#1	X =	-0.4202 m.	+4.621E-06	-4.300E-07	+7.299E-07
	Y =	-1.2981 m.	-4.300E-07	+3.703E-06	+3.339E-07
	Z =	0.9382 m.	+7.299E-07	+3.339E-07	+5.628E-06
	Azim. =	19 50 43.9750	+1.680E-06	-2.153E-07	-3.530E-07
	Elev. =-	28 07 18.6050	-2.153E-07	+1.680E-06	-3.530E-07
	Swing =	04 19 19.1519	-3.530E-07	-3.530E-07	+1.426E-06
#2	X =	0.9591 m.	+5.169E-06	+1.535E-06	-8.687E-07
	Y =	-1.2663 m.	+1.535E-06	+4.188E-06	+6.254E-07
	Z =	0.9626 m.	-8.687E-07	+6.254E-07	+5.765E-06
	Azim. =	332 52 40.0853	+1.844E-06	+1.201E-08	-3.896E-07
	Elev. =-	29 29 36.4430	+1.201E-08	+1.844E-06	-3.896E-07
	Swing =-	01 57 52.1536	-3.896E-07	-3.896E-07	+1.152E-06
#3	X =	1.8605 m.	+4.568E-06	+1.157E-06	+1.433E-06
	Y =	-0.3919 m.	+1.157E-06	+5.927E-06	+2.108E-07
	Z =	0.9121 m.	+1.433E-06	+2.108E-07	+1.063E-05
	Azim. =	299 35 47.0441	+1.616E-06	+2.794E-07	-7.710E-07
	Elev. =-	28 25 56.5311	+2.794E-07	+1.616E-06	-7.710E-07
	Swing =	00 54 35.2447	-7.710E-07	-7.710E-07	+3.511E-06
#4	X =	1.8857 m.	+5.353E-06	-2.966E-06	-1.193E-06
	Y =	1.1240 m.	-2.966E-06	+1.203E-05	+1.526E-06
	Z =	0.8633 m.	-1.193E-06	+1.526E-06	+1.123E-05
	Azim. =	246 54 29.5476	+2.624E-06	+4.737E-07	-1.147E-07
	Elev. =-	26 20 3.8353	+4.737E-07	+2.624E-06	-1.147E-07
	Swing =-	01 42 27.3195	-1.147E-07	-1.147E-07	+3.989E-06

	X =	1.0024 m.	+1.243E-05	-2.054E-06	+1.176E-06
#5	Y =	2.0435 m.	-2.054E-06	+6.210E-06	-9.771E-07
	Z =	0.8161 m.	+1.176E-06	-9.771E-07	+1.148E-05
	Azim. = 202 03 15.2619		+2.350E-06	+2.642E-07	+3.948E-07
	Elev. =- 26 10 27.3019		+2.642E-07	+2.350E-06	+3.948E-07
	Swing =- 02 24 9.5880		+3.948E-07	+3.948E-07	+1.804E-06
	X =	-0.3616 m.	+6.813E-06	+7.454E-07	+5.804E-07
#6	Y =	2.0920 m.	+7.454E-07	+5.103E-06	-2.669E-07
	Z =	0.7872 m.	+5.804E-07	-2.669E-07	+8.967E-06
	Azim. = 158 34 26.3098		+1.428E-06	+1.194E-07	+2.166E-07
	Elev. =- 22 25 15.6254		+1.194E-07	+1.428E-06	+2.166E-07
	Swing =- 00 11 47.8227		+2.166E-07	+2.166E-07	+1.300E-06

SUMMARY STATISTICS FOR CAMERA STATIONS

RMS For Standard Deviations

	X =	0.0025 m.	Azim. =	00 04 46.0957
Count = 6	Y =	0.0025 m.	Elev. =	00 06 10.0783
	Z =	0.0030 m.	Swing =	00 05 5.7246

TRIANGULATED OBJECT POINTS

Ident	Position (meters)		Covariance Matrix			Std Dev (m)
	X =	0.2977	+2.299E-07	+9.901E-09	+4.550E-08	0.0005
a	Y =	0.0099	+9.901E-09	+2.498E-07	-3.700E-08	0.0005
	Z =	-0.0707	+4.550E-08	-3.700E-08	+2.204E-07	0.0005
	X =	0.2988	+2.460E-07	+1.038E-08	+5.062E-08	0.0005
b	Y =	0.0088	+1.038E-08	+2.727E-07	-3.958E-08	0.0005
	Z =	-0.1351	+5.062E-08	-3.958E-08	+2.423E-07	0.0005
	X =	0.5555	+7.041E-07	+2.934E-07	+2.662E-07	0.0008
c	Y =	0.0766	+2.934E-07	+1.328E-06	+5.841E-07	0.0012
	Z =	-0.3266	+2.662E-07	+5.841E-07	+9.724E-07	0.0010
	X =	0.2991	+8.934E-07	-3.066E-08	+1.136E-07	0.0009
d	Y =	0.7227	-3.066E-08	+9.283E-07	+1.612E-07	0.0010
	Z =	-0.1620	+1.136E-07	+1.612E-07	+9.815E-07	0.0010
	X =	0.2996	+8.979E-07	-1.685E-08	+1.165E-07	0.0009
e	Y =	0.7200	-1.685E-08	+9.408E-07	+1.944E-07	0.0010
	Z =	-0.2236	+1.165E-07	+1.944E-07	+1.003E-06	0.0010
	X =	0.0549	+2.085E-06	+8.680E-07	+4.311E-07	0.0014
g	Y =	-0.9181	+8.680E-07	+2.233E-05	+6.122E-06	0.0047
	Z =	-0.2093	+4.311E-07	+6.122E-06	+4.159E-06	0.0020
	X =	0.6597	+2.644E-06	-2.287E-06	-2.968E-07	0.0016
h	Y =	-1.0184	-2.287E-06	+2.439E-05	+5.651E-06	0.0049
	Z =	-0.0603	-2.968E-07	+5.651E-06	+4.248E-06	0.0021

	X =	0.8362	+3.492E-06	-4.007E-06	-1.737E-06	0.0019
i	Y =	-0.6713	-4.007E-06	+2.451E-05	+1.099E-05	0.0050
	Z =	-0.7043	-1.737E-06	+1.099E-05	+8.327E-06	0.0029
	X =	0.0701	+6.973E-07	-1.521E-08	+5.814E-08	0.0008
c1	Y =	0.6693	-1.521E-08	+7.332E-07	+2.923E-08	0.0009
	Z =	0.0204	+5.814E-08	+2.923E-08	+7.703E-07	0.0009
	X =	0.0197	+6.996E-07	+1.284E-08	+5.225E-08	0.0008
c2	Y =	0.6681	+1.284E-08	+7.990E-07	+4.640E-08	0.0009
	Z =	0.0200	+5.225E-08	+4.640E-08	+7.899E-07	0.0009
	X =	0.0181	+7.698E-07	-1.455E-08	+5.823E-08	0.0009
c3	Y =	0.7182	-1.455E-08	+7.890E-07	+3.849E-08	0.0009
	Z =	0.0163	+5.823E-08	+3.849E-08	+8.665E-07	0.0009
	X =	0.0682	+7.794E-07	-2.070E-08	+6.250E-08	0.0009
c4	Y =	0.7196	-2.070E-08	+8.027E-07	+3.957E-08	0.0009
	Z =	0.0166	+6.250E-08	+3.957E-08	+8.691E-07	0.0009
	X =	0.0706	+7.813E-07	+9.717E-09	+9.401E-08	0.0009
c5	Y =	0.6656	+9.717E-09	+7.551E-07	+3.135E-08	0.0009
	Z =	-0.0303	+9.401E-08	+3.135E-08	+8.187E-07	0.0009

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azimuth - elevation - swing

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
		X =	0.0190	+8.134E-07	+5.276E-08	+7.591E-08	0.0009
c7		Y =	0.7157	+5.276E-08	+9.010E-07	+1.313E-07	0.0009
		Z =	-0.0337	+7.591E-08	+1.313E-07	+9.307E-07	0.0010
		X =	0.0688	+8.108E-07	-1.775E-08	+7.721E-08	0.0009
c8		Y =	0.7164	-1.775E-08	+8.125E-07	+9.019E-08	0.0009
		Z =	-0.0336	+7.721E-08	+9.019E-08	+8.989E-07	0.0009
		X =	0.0252	+1.039E-07	+6.685E-10	+9.451E-09	0.0003
sp1	*0*	Y =	-0.0252	+6.685E-10	+1.210E-07	-9.075E-09	0.0003
		Z =	0.0259	+9.451E-09	-9.075E-09	+9.794E-08	0.0003
		X =	-0.0256	+1.060E-07	+2.951E-10	+9.440E-09	0.0003
sp2	*0*	Y =	-0.0250	+2.951E-10	+1.239E-07	-9.308E-09	0.0004
		Z =	0.0256	+9.440E-09	-9.308E-09	+1.007E-07	0.0003
		X =	-0.0255	+1.061E-07	+2.216E-10	+9.460E-09	0.0003
sp3	*0*	Y =	0.0254	+2.216E-10	+1.253E-07	-8.661E-09	0.0004
		Z =	0.0255	+9.460E-09	-8.661E-09	+9.997E-08	0.0003
		X =	0.0249	+1.039E-07	+4.784E-10	+9.529E-09	0.0003
sp4	*0*	Y =	0.0253	+4.784E-10	+1.224E-07	-8.430E-09	0.0003
		Z =	0.0256	+9.529E-09	-8.430E-09	+9.729E-08	0.0003
		X =	0.0653	+9.585E-07	-3.486E-08	+7.054E-08	0.0010
lfc1		Y =	0.8193	-3.486E-08	+9.462E-07	+6.130E-08	0.0010

	Z =	0.0114	+7.054E-08	+6.130E-08	+1.086E-06	0.0010
	X =	0.0152	+9.840E-07	-2.798E-08	+7.667E-08	0.0010
lfc2	Y =	0.8187	-2.798E-08	+9.445E-07	+7.842E-08	0.0010
	Z =	0.0111	+7.667E-08	+7.842E-08	+1.113E-06	0.0011
	X =	0.0145	+1.044E-06	-3.305E-08	+6.874E-08	0.0010
lfc3	Y =	0.8687	-3.305E-08	+1.002E-06	+7.181E-08	0.0010
	Z =	0.0085	+6.874E-08	+7.181E-08	+1.205E-06	0.0011
	X =	0.0646	+1.144E-06	-1.906E-08	+1.163E-07	0.0011
lfc4	Y =	0.8699	-1.906E-08	+1.056E-06	+5.492E-08	0.0010
	Z =	0.0088	+1.163E-07	+5.492E-08	+1.261E-06	0.0011
	X =	0.0662	+1.159E-06	+5.931E-09	+1.777E-07	0.0011
lfc5	Y =	0.8170	+5.931E-09	+9.900E-07	+9.966E-08	0.0010
	Z =	-0.0394	+1.777E-07	+9.966E-08	+1.205E-06	0.0011
	X =	0.0156	+1.060E-06	-1.282E-07	+1.681E-08	0.0010
lfc6	Y =	0.8152	-1.282E-07	+1.310E-06	+1.468E-07	0.0011
	Z =	-0.0391	+1.681E-08	+1.468E-07	+1.219E-06	0.0011
	X =	0.0648	+1.120E-06	-2.761E-08	+7.216E-08	0.0011
lfc8	Y =	0.8673	-2.761E-08	+1.225E-06	+2.379E-07	0.0011
	Z =	-0.0411	+7.216E-08	+2.379E-07	+1.356E-06	0.0012

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azimuth - elevation - swing

TRIANGULATED OBJECT POINTS

Ident		Position (meters)		Covariance Matrix		Std Dev (m)
	X =	0.0252	+1.185E-07	+2.364E-09	+1.289E-08	0.0003
rtc1	*0* Y =	-0.0249	+2.364E-09	+1.258E-07	-1.547E-08	0.0004
	Z =	-0.0250	+1.289E-08	-1.547E-08	+1.123E-07	0.0003
	X =	-0.0247	+1.204E-07	-1.159E-08	+9.750E-09	0.0003
rtc2	*0* Y =	-0.0250	-1.159E-08	+1.464E-07	-2.257E-08	0.0004
	Z =	-0.0261	+9.750E-09	-2.257E-08	+1.243E-07	0.0004
	X =	-0.0252	+1.269E-07	+1.950E-08	+1.351E-09	0.0004
rtc3	*0* Y =	0.0251	+1.950E-08	+1.742E-07	-1.537E-09	0.0004
	Z =	-0.0255	+1.351E-09	-1.537E-09	+1.269E-07	0.0004
	X =	0.0253	+1.318E-07	-4.612E-09	+1.911E-08	0.0004
rtc4	*0* Y =	0.0250	-4.612E-09	+1.357E-07	+1.511E-09	0.0004
	Z =	-0.0253	+1.911E-08	+1.511E-09	+1.163E-07	0.0003
	X =	-0.0246	+1.454E-07	-7.271E-09	+5.408E-09	0.0004
rtc6	*0* Y =	-0.0254	-7.271E-09	+1.950E-07	-4.951E-08	0.0004
	Z =	-0.0767	+5.408E-09	-4.951E-08	+1.741E-07	0.0004
	X =	-0.0246	+1.795E-07	+1.749E-08	-1.396E-08	0.0004
rtc7	*0* Y =	0.0256	+1.749E-08	+2.335E-07	-4.602E-08	0.0005
	Z =	-0.0756	-1.396E-08	-4.602E-08	+2.085E-07	0.0005

		X =	0.0254	+2.063E-07	-2.994E-08	+2.360E-08	0.0005
rtc8	*0*	Y =	0.0252	-2.994E-08	+2.257E-07	-3.314E-08	0.0005
		Z =	-0.0765	+2.360E-08	-3.314E-08	+2.116E-07	0.0005
		X =	0.1513	+1.271E-07	-5.154E-09	+1.909E-08	0.0004
x+06	*0*	Y =	0.0000	-5.154E-09	+1.306E-07	-3.167E-10	0.0004
		Z =	0.0008	+1.909E-08	-3.167E-10	+1.126E-07	0.0003
		X =	0.3033	+1.137E-07	+8.661E-10	+9.999E-09	0.0003
x+12	*0*	Y =	-0.0005	+8.661E-10	+1.262E-07	-7.340E-09	0.0004
		Z =	0.0009	+9.999E-09	-7.340E-09	+1.101E-07	0.0003
		X =	0.4566	+1.351E-07	+3.873E-10	+9.812E-09	0.0004
x+18	*0*	Y =	-0.0005	+3.873E-10	+1.464E-07	-7.028E-09	0.0004
		Z =	0.0003	+9.812E-09	-7.028E-09	+1.365E-07	0.0004
		X =	0.6075	+1.788E-07	-4.605E-09	+1.159E-08	0.0004
x+24	*0*	Y =	0.0000	-4.605E-09	+1.882E-07	-5.868E-09	0.0004
		Z =	-0.0017	+1.159E-08	-5.868E-09	+1.825E-07	0.0004
		X =	-0.0003	+1.172E-07	+6.907E-10	+8.754E-09	0.0003
y+06	*0*	Y =	0.1520	+6.907E-10	+1.351E-07	-5.050E-09	0.0004
		Z =	0.0002	+8.754E-09	-5.050E-09	+1.132E-07	0.0003
		X =	-0.0001	+1.517E-07	+1.086E-09	+6.269E-09	0.0004
y+12	*0*	Y =	0.3043	+1.086E-09	+1.610E-07	-6.024E-10	0.0004
		Z =	0.0008	+6.269E-09	-6.024E-10	+1.571E-07	0.0004

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)		Covariance Matrix			Std Dev (m)
		X =	0.0004	+1.245E-07	-5.917E-10	+4.709E-09	0.0004
y-06	*0*	Y =	-0.1518	-5.917E-10	+1.532E-07	-1.987E-08	0.0004
		Z =	0.0002	+4.709E-09	-1.987E-08	+1.351E-07	0.0004
		X =	0.0007	+1.926E-07	+1.749E-08	+9.474E-09	0.0004
y-12	*0*	Y =	-0.3052	+1.749E-08	+2.329E-07	+1.667E-08	0.0005
		Z =	0.0000	+9.474E-09	+1.667E-08	+1.929E-07	0.0004
		X =	-0.0007	+1.086E-07	+9.350E-10	+8.399E-09	0.0003
z+06	*0*	Y =	0.0004	+9.350E-10	+1.323E-07	-7.803E-09	0.0004
		Z =	0.1513	+8.399E-09	-7.803E-09	+9.708E-08	0.0003
		X =	-0.0007	+1.390E-07	+1.416E-09	+5.661E-09	0.0004
z+12	*0*	Y =	0.0006	+1.416E-09	+1.869E-07	-1.030E-08	0.0004
		Z =	0.3039	+5.661E-09	-1.030E-08	+1.253E-07	0.0004

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

Count =	22	X =	0.0010 meters
Count =	22	Y =	0.0020 meters

Count = 22 Z = 0.0013 meters

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azimuth - elevation - swing

CORRECTIONS APPLIED TO OBJECT CONTROL

	X =	-0.0002 m		X =	-0.0002 m
rtc1	Y =	0.0005 m	sp1	Y =	0.0002 m
	Z =	0.0004 m		Z =	0.0005 m
	X =	-0.0015 m		X =	-0.0001 m
x+12	Y =	-0.0005 m	y+12	Y =	-0.0005 m
	Z =	0.0009 m		Z =	0.0008 m
	X =	-0.0007 m		X =	0.0007 m
z+12	Y =	0.0006 m	y-12	Y =	-0.0004 m
	Z =	-0.0009 m		Z =	0.0000 m
	X =	0.0007 m		X =	-0.0002 m
rtc2	Y =	0.0004 m	sp2	Y =	0.0004 m
	Z =	-0.0007 m		Z =	0.0002 m
	X =	0.0002 m		X =	-0.0001 m
rtc3	Y =	-0.0003 m	sp3	Y =	0.0000 m
	Z =	-0.0001 m		Z =	0.0001 m
	X =	0.0027 m		X =	-0.0001 m
x+24	Y =	0.0000 m	rtc4	Y =	-0.0004 m
	Z =	-0.0017 m		Z =	0.0001 m
	X =	-0.0005 m		X =	-0.0011 m
sp4	Y =	-0.0001 m	x+06	Y =	0.0000 m
	Z =	0.0002 m		Z =	0.0008 m
	X =	-0.0003 m		X =	-0.0007 m
y+06	Y =	-0.0004 m	z+06	Y =	0.0004 m
	Z =	0.0002 m		Z =	-0.0011 m
	X =	0.0004 m		X =	0.0008 m
y-06	Y =	0.0006 m	rtc6	Y =	0.0000 m
	Z =	0.0002 m		Z =	-0.0005 m
	X =	0.0008 m		X =	-0.0006 m
rtc7	Y =	0.0002 m	x+18	Y =	-0.0005 m
	Z =	0.0006 m		Z =	0.0003 m
	X =	0.0000 m			
rtc8	Y =	-0.0002 m			
	Z =	-0.0003 m			

X .... Number of Components = 21 RMS = 0.0008 meters
Y .... Number of Components = 21 RMS = 0.0004 meters
Z .... Number of Components = 21 RMS = 0.0006 meters

Appendix C
Program Listings

XPREP Program Listing

```
F77L - Lahey FORTRAN 77, Version 5.01    20 Apr 93 14:51:12                    Page    1
PROGRAM XPREP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

       1        PROGRAM XPREP
       2        WRITE (*,*) ' Enter 1 for HEAD digitization '
       3        WRITE (*,*) ' Enter 2 for BODY digitization '
       4        READ (*,*) I
       5        IF(I.EQ.1)CALL HEAD
       6        IF(I.EQ.2)CALL BODY
       7        END


F77L - Lahey FORTRAN 77, Version 5.01    20 Apr 93 14:51:12                    Page    2
SUBROUTINE HEAD     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

       8
       9        SUBROUTINE HEAD
      10        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      11        CHARACTER   DATA*17, fn1*12, fn2*12, fn3*12, fn4*12
      12        CHARACTER*8 IFRAM(6),IDCAL(2,19),IDHED(19), IDPT, DAY
      13        CHARACTER JTITLE*42
      14        COMMON /TITLEP/ JTITLE, I    Page
      15        INTEGER     IDFD(10), IBUTT,IFID,IRED,IX,IY
      16        REAL*8      XY(2,21,3), CALFID(2,10,2)
      17        logical     iflag
      18        EXTERNAL    SYSTEM
      19        INTRINSIC   CHAR,DFLOAT,  DSIN, DCOS, DSQRT
      20        COMMON      CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
      21        DATA IFRAM /'A/Pprism','LATprism',
      22       .            'A/Phrv90','LAThrv90','A/Phrv45','LAThrv45'/
      23        DATA IDCAL /'c3','c5',2*'c13','c4','c8',2*'c11',2*'c10',2*'c9',
      24       .            'c2','c6',2*'c12','c1','c7',2*'cv1',2*'cv2',2*'cv3',
      25       .       2*'cv4',2*'cv5',2*'cv6',2*'cv7',2*'cv8',2*'cv9',2*'cv10'/
      26        DATA IDHED /'lam','ram','lon','ron','ltp','rtp','ctp','chin',
      27       .            'ltuskF','ltuskM','ltuskR','rtuskF','rtuskM','rtuskR',
      28       .            'capLfF','capLfR','capRtF','capRtR','capCEN'/
      29        DATA CALFID/-147.150, 190.190,-160.380,  77.030,-158.830, -77.220,
      30       .            -146.442,-192.510,   5.760, 190.060,   5.990,-191.570,
      31       .             157.980, 190.490, 146.070,  75.380, 147.920, -77.730,
      32       .             158.540,-191.520,-148.160, 193.950,-162.380,  80.380,
      33       .            -164.310, -75.670,-148.961,-191.214,   5.010, 193.920,
      34       .               4.800,-192.310, 159.210, 193.010, 147.600,  80.050,
      35       .             144.880, -75.390, 158.520,-192.720/
      36  C ------------------------------------------------------
      37  C       ALTEK DIGITIZER 4-BUTTON KEY CONTROL MEANINGS:
      38  C                     #2:RED=ERROR-BACKUP
      39  C       #4:BLUE=???                          #1:YELLOW=MISSING
      40  C                 #3:GREEN=FIDUCIAL or DATA POINT
      41  C------------------------------------------------------
      42        NHED=19
```

```
      I    Page=0
      WRITE (*,*) ' Enter COMM Port number: '
      READ (*,*) Icmm
      icmm=icmm+48
      CALL SYSTEM ('MODE COM'//char(icmm)//':9600,O,7,2')
      OPEN (11,FILE ='COM'//char(icmm),   ACCESS='TRANSPARENT')
C
      WRITE (*,*) ' Enter HRV number: '
      READ (*,*) IHRV
      WRITE (*,*)
      WRITE (FN1, '(I4.4,''HEAD.OUT'')')IHRV
      WRITE (FN2, '(I4.4,''head.132'')')IHRV
      WRITE (FN3, '(I4.4, ''himg.dat'')')IHRV
      WRITE (FN4, '(I4.4, ''head.in'')')IHRV
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/1/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      OPEN ( 8,FILE =FN2)
      OPEN ( 9,FILE =FN3)
      OPEN (10,FILE =FN1)
      OPEN (12,FILE =FN4)
      CALL DATE (DAY)
      WRITE (JTITLE,
     .'('' HRV # '',I5.5,''       Date: '',A8,''     HEAD   '')') IHRV, DAY
C  Read order of transformation
      WRITE (*,*) ' Enter number of parameters for shrinkage fit: '
      READ (*,*) IOPT1
      WRITE (*,*)
      units=25.4d-3
      SDX = .75
      SDY = .75
      IF (IOPT1.GT.6)IOPT1=8
      ICH3S=0
      IF (IOPT1.LE.3) THEN
           ICH3S=1
           IOPT1=3
      END IF
C      IOPT3=0
C  NRED indicates the number of replications of plate coordinates
      NRED=1
C
 1    WRITE (*,*) ' Enter 0 when finished'
      WRITE (*,*) ' Enter 1 if:  A/P / CALIBRATION PRISM'
      WRITE (*,*) ' Enter 2 if:  LAT / CALIBRATION PRISM'
      WRITE (*,*) ' Enter 3 if:  A/P / HRV / 90 deg'
      WRITE (*,*) ' Enter 4 if:  LAT / HRV / 90 deg'
      WRITE (*,*) ' Enter 5 if:  A/P / HRV / 45 deg'
      WRITE (*,*) ' Enter 6 if:  LAT / HRV / 45 deg'
      WRITE (*,*)
      READ (*,*) IANS
      if(ians.eq.0) go to 999
C
C  Input data for the Preprocessing Program:
C     3, 4, 5, 6, 8 in col. 1  Three(etc)-parameter transformation
C
C     Calibrated Fiducial Coordinates in   FORMAT (2X,I4,4X,2F10.4)
C
C     Radial Lens Distortion Function:
C       Coefficients FK0, FK1              FORMAT (2D20.10)
C       Coefficients FK2, FK3              FORMAT (2D20.10)
C
```

```
101         CALL CLEAR
102   C
103         FOCAL= -889.D0
104         IF (MOD(IANS,2).EQ.1) FOCAL= -1820.D0
105         CALL NEWPAG
```

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SUBROUTINE HEAD Compiling Options:
/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
106         WRITE (8,1400) IFRAM(IANS)
107         WRITE (10,2400)IFRAM(IANS)
108         write (12, '(i1, 9x, 3f10.3)')iopt1, focal, sdx, sdy
109   C
110   C  Write Calibrated Fiducial Coordinates
111   C
112         JFID=2-MOD(IANS,2)
113         do 8 ifid=1, 10
114         WRITE ( 8,1420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
115         WRITE (10,2420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
116    8    WRITE (12,1410) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
117         write (12, '(////)')
118   C
119   C  Read & Write Frame ID
120   C
121         WRITE ( 9,1516) IFRAM(IANS), FOCAL, SDX, SDY
122         WRITE (12,'(A8)') IFRAM(IANS)
123         CALL NEWPAG
124         WRITE ( 8,1380) IFRAM(IANS)
125         WRITE (10,2380) IFRAM(IANS)
126         NRED=1
127   C*************************************************************************
128   C  Start major loop for digitizing x-rays:
129         iflag=.true.
130         DO 40 IRED=1,NRED
131         IFID=1
132    10   READ (11) DATA
133         WRITE (*,*) CHAR(7)
134   C
135   C  DECODE data from CHARACTER to INTEGER
136   C
137         if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
138         READ (DATA, 20) IBUTT,IX,IY
139    20   FORMAT (I1,1X,I6,1X,I6)
140   C
141   C  Interpret action to take based on which button was pressed:
142         IF (IBUTT .EQ. 3) THEN
143             XY(1,IFID,IRED)=IX*units
144             XY(2,IFID,IRED)=IY*units
145             WRITE (*,30) 'FIDUCIAL',IFID,XY(1,IFID,IRED),XY(2,IFID,IRED)
146    30       FORMAT (' ',A,1X,I3,2X,F8.4,2X,F8.4)
147             if(iflag)then
148                 isavex=ix
149                 isavey=iy
150                 iflag=.false.
151              endif
152             IFID=IFID+1
153         ELSEIF (IBUTT .EQ. 2) THEN
154             IFID=IFID-1
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
155             WRITE (*,*) 'Backing up one to FIDUCIAL # ',IFID
156             WRITE (*,*) CHAR(7),CHAR(7)
157         ELSEIF (IBUTT .EQ. 1) THEN
158             XY(1,IFID,IRED)=-1.
159             XY(2,IFID,IRED)=-1.
160             WRITE (*,*) 'MISSING ', IFID
161             IFID=IFID+1
162         ELSE
163             WRITE (*,*) 'Not an option. Redo'
164         ENDIF
165         IF (IFID .LE. 10) GO TO 10
166   40    CONTINUE
167   C
168   C  Write out the raw data to raw.dat
169         DO 60 IFID=1,10
170         IF (XY(1,IFID,1).GT.0) WRITE (12,50) IFID,( XY(1,IFID,IRED),
171        .        XY(2,IFID,IRED),IRED=1,NRED)
172    50   FORMAT (6X,I4,S,6F10.3)
173    60   CONTINUE
174         WRITE (12,*)
175   C
176         IFID=0
177         DO 200 K=1,10
178   C
179   C  Read measured fiducial coordinates
180   C
181              IFID=IFID+1
182    80        IF (IFID.GT.10) GO TO 210
183              IF (XY(1,IFID,1).LE.0) then
184                 IFID=IFID+1
185                 GO TO 80
186              ENDIF
187              KK=IFID
188              XMAX=0.0D0
189              YMAX=0.0D0
190              XMIN=1000.0D0
191              YMIN=1000.0D0
192              SUMX=0.0D0
193              SUMY=0.0D0
194              DO 100 J=1,NRED
195                   X=XY(1,IFID,J)
196                   Y=XY(2,IFID,J)
197                   IF (X.EQ.0.AND.Y.EQ.0) GO TO 110
198                   SUMX=SUMX+X
199                   SUMY=SUMY+Y
200                   IF (NRED.EQ.1) GO TO 100
201                   IF (XMAX.LT.X) XMAX=X
202                   IF (XMIN.GT.X) XMIN=X
203                   IF (YMAX.LT.Y) YMAX=Y
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
204                   IF (YMIN.GT.Y) YMIN=Y
205   100         CONTINUE
206               IF (NRED.NE.1) GO TO 120
207   110         XMIN=0.0D0
```

```
208             YMIN=0.0D0
209   120       J=NRED
210             IF (J.EQ.0) J=1
211             XT=SUMX/J
212             YT=SUMY/J
213   C   Store averaged digitized coordinates
214             OBSCOR(1,K)=XT
215             OBSCOR(2,K)=YT
216             CALCOR(1,K)=CALFID(1,KK,JFID)
217             CALCOR(2,K)=CALFID(2,KK,JFID)
218             IDFD(K)=KK
219             WRITE ( 8,1540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
220             WRITE (10,2540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
221    200  CONTINUE
222   C
223   C  Compute the 3-Parameter Check Transformation.
224   C
225    210  NFID=K-1
226         ICH3S=1
227         CALL FOURP
228         WRITE (*,*)' 3-Parameter Check Transformation'
229         rmsx=0.
230         rmsy=0.
231         DO 220 I=1,NFID
232           X=OBSCOR(1,I)
233           Y=OBSCOR(2,I)
234          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
235          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
236           KK=IDFD(I)
237           WRITE ( *,2560) KK,XT,YT
238           rmsx=rmsx+xt*xt
239           rmsy=rmsy+yt*yt
240    220 CONTINUE
241         rmsx3=dsqrt(rmsx/nfid)
242         rmsy3=dsqrt(rmsy/nfid)
243         write (*,230)rmsx, rmsy
244    230  format (' rms= ',2f7.3)
245         WRITE (*,*)
246         WRITE (*,*)iopt1,'-Parameter Transformation'
247         rmsx=0.
248         rmsy=0.
249   C
250   C  Compute the Multi-Parameter Transformation.
251         ICH3=ICH3S
252         IF (IOPT1.LE.5) CALL FOURP
```


SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
253         IF (IOPT1.EQ.5) CALL FIVEP
254         IF (IOPT1.EQ.6) CALL SIXP
255         IF (IOPT1.EQ.8) CALL EIGHTP
256         WRITE ( 8,1550) IOPT1
257         WRITE (10,2550) IOPT1
258   C
259   C  Compute Residuals For the Fiducial Coordinates
260   C
261         DO 240 I=1,NFID
262           X=OBSCOR(1,I)
263           Y=OBSCOR(2,I)
264          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
265          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
```

```
      266         KK=IDFD(I)
      267         WRITE ( 8,1560) KK,XT,YT
      268         WRITE (10,2560) KK,XT,YT
      269         WRITE ( *,2560) KK,XT,YT
      270         rmsx=rmsx+xt*xt
      271         rmsy=rmsy+yt*yt
      272    240 CONTINUE
      273         rmsx=dsqrt(rmsx/nfid)
      274         rmsy=dsqrt(rmsy/nfid)
      275         write (*,230)rmsx, rmsy
      276         write( 8, 1545)rmsx, rmsy, rmsx3, rmsy3, del
      277         write(10, 2545)rmsx, rmsy, rmsx3, rmsy3, del
      278    1545 FORMAT(/43X,'RMS',2F15.3/43X,'RMS(CHECK)',F8.3, F15.3/
      279        .       /45X,'TRANSFORMATION PARAMETERS ARE:'/33X,2F11.6,F11.4,
      280        .                              2F11.6/33X,2F11.6,F11.4//)
      281    2545 FORMAT(/23X,'Rms',2F15.3/23X,'Rms(check)',F8.3, F15.3/
      282        .       /25X,'Transformation Parameters Are:'/13X,2F11.6,F11.4,
      283        .                              2F11.6/13X,2F11.6,F11.4)
      284         CALL NEWPAG
      285         IF (NRED .GT. 1) WRITE (8,1570) IFRAM(IANS)
      286         IF (NRED .GT. 1) WRITE (10,2570)IFRAM(IANS)
      287         IF (NRED .EQ. 1) WRITE (8,1575) IFRAM(IANS)
      288         IF (NRED .EQ. 1) WRITE (10,2575)IFRAM(IANS)
      289         PAUSE
      290   C*********************************************************************
      291         IF (IANS.GE.3) GO TO 500
      292   C  Compute the Averaged Coordinates of the Calibration Prism
      293   C
      294   C1250 READ ( 7,1580) IDPT,((TEMPM1(I,J),I=1,2),J=1,NRED)
      295         DO 260 IRED=1,NRED
      296         ICAL=1
      297    250  READ (11) DATA
      298         WRITE (*,*) CHAR(7)
      299   C
      300   C  DECODE data from CHARACTER to INTEGER
      301   C
      302         if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
```



```
SUBROUTINE HEAD     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

      303         READ (DATA, 20) IBUTT,IX,IY
      304   C
      305   C  Interpret action to take based on which button was pressed:
      306         IF (IBUTT .EQ. 3) THEN
      307             XY(1,ICAL,IRED)=IX*units
      308             XY(2,ICAL,IRED)=IY*units
      309             WRITE (*,30)'CAL. PT.',ICAL,XY(1,ICAL,IRED),XY(2,ICAL,IRED)
      310             ICAL=ICAL+1
      311         ELSEIF (IBUTT .EQ. 2) THEN
      312             ICAL=ICAL-1
      313             WRITE (*,*) 'Backing up one to CAL. PT. # ',ICAL
      314             WRITE (*,*) CHAR(7),CHAR(7)
      315         ELSEIF (IBUTT .EQ. 1) THEN
      316             XY(1,ICAL,IRED)=-1.
      317             XY(2,ICAL,IRED)=-1.
      318             WRITE (*,*) 'MISSING ', ICAL
      319             ICAL=ICAL+1
      320         ELSE
      321             WRITE (*,*) 'Not an option. Redo'
      322         ENDIF
      323         IF (ICAL .LE. 19) GO TO 250
```

```
 260  CONTINUE
C
      DO 280 ICAL=1,19
         IF (XY(1,ICAL,1).GT.0) WRITE (12,270) IDCAL(IANS,ICAL),
     .           (XY(1,ICAL,IRED),XY(2,ICAL,IRED),IRED=1,NRED)
 270     FORMAT (2X,A8,1X,S,6(F9.4,1X))
 280  CONTINUE
      WRITE (12,*)
C
      ICAL=0
      DO 390 K=1,19
C
C  Process measured calibration prism coordinates
C
            ICAL=ICAL+1
 290        IF (ICAL.GT.19) GO TO 400
            IF (XY(1,ICAL,1).LE.0) then
               ICAL=ICAL+1
               GO TO 290
            ENDIF
            KK=ICAL
            XMAX=0.0D0
            YMAX=0.0D0
            XMIN=1000.0D0
            YMIN=1000.0D0
            SUMX=0.0D0
            SUMY=0.0D0
            DO 300 J=1,NRED
```



```
SUBROUTINE HEAD     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

                  X=XY(1,ICAL,J)
                  Y=XY(2,ICAL,J)
                  IF (X.EQ.0.AND.Y.EQ.0) GO TO 310
                  SUMX=SUMX+X
                  SUMY=SUMY+Y
                  IF (NRED.EQ.1) GO TO 300
                  IF (XMAX.LT.X) XMAX=X
                  IF (XMIN.GT.X) XMIN=X
                  IF (YMAX.LT.Y) YMAX=Y
                  IF (YMIN.GT.Y) YMIN=Y
 300        CONTINUE
            IF (NRED.NE.1) GO TO 320
 310        XMIN=0.0D0
            YMIN=0.0D0
 320        J=NRED
            IF (J.EQ.0) J=1
            X=SUMX/J
            Y=SUMY/J
            XM=XMAX-XMIN
            YM=YMAX-YMIN
            IDPT=IDCAL(IANS,KK)
C
C  Correct Measured Coordinates for Film Shrinkage
C
      XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
      YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
C
      IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
      IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
      IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
```

```
      IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
C
C  Write Records for Triangulation Input to File: "img.dat"
C
      WRITE (9,1610) IDPT,XT,YT,IFRAM(IANS)
 390  CONTINUE
C
 400  write (*,*)' Re-do first fiducial'
      READ (11) DATA
      WRITE (*,*) CHAR(7)
C
C  DECODE data from CHARACTER to INTEGER
C
      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
      READ (DATA, 20) IBUTT,IX,IY
      if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
         write (*,*)'  You blew it', ix, iy, ' vs.', isavex, isavey
         WRITE (*,*) CHAR(7)
         WRITE (*,*) CHAR(7)
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
         go to 400
      endif
      PAUSE
      WRITE (9,'(A8)') '********'
      GO TO 1
C*********************************************************************
C
C  Compute the Averaged Coordinates of the HRV head
C
 500  DO 560 IRED=1,NRED
      IHED=1
 550  READ (11) DATA
      WRITE (*,*) CHAR(7)
C
C  DECODE data from CHARACTER to INTEGER
C
      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
      READ (DATA, 20) IBUTT,IX,IY
C
C  Interpret action to take based on which button was pressed:
      IF (IBUTT .EQ. 3) THEN
          XY(1,IHED,IRED)=IX*units
          XY(2,IHED,IRED)=IY*units
          WRITE (*,555)IDHED(IHED),XY(1,IHED,IRED),XY(2,IHED,IRED)
 555      FORMAT (A10,2X,F8.4,2X,F8.4)
          IHED=IHED+1
      ELSEIF (IBUTT .EQ. 2) THEN
          IHED=IHED-1
          WRITE (*,*) 'Backing up one to ',IDHED(IHED)
          WRITE (*,*) CHAR(7),CHAR(7)
      ELSEIF (IBUTT .EQ. 1) THEN
          XY(1,IHED,IRED)=-1.
          XY(2,IHED,IRED)=-1.
          WRITE (*,*) 'MISSING ', IDHED(IHED)
          IHED=IHED+1
      ELSE
          WRITE (*,*) 'Not an option. Redo'
      ENDIF
      IF (IHED .LE. NHED) GO TO 550
```

```
  560  CONTINUE
C
      DO 580 IHED=1,NHED
         IF (XY(1,IHED,1).GT.0) WRITE (12,270) IDHED(IHED),
     .           (XY(1,IHED,IRED),XY(2,IHED,IRED),IRED=1,NRED)
  580  CONTINUE
      WRITE (12,*)
C
      IHED=0
      DO 690 K=1,NHED
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
C
C  Process measured head coordinates
C
           IHED=IHED+1
  590      IF (IHED.GT.NHED) GO TO 700
           IF (XY(1,IHED,1).LE.0) then
              IHED=IHED+1
              GO TO 590
           ENDIF
           KK=IHED
           XMAX=0.0D0
           YMAX=0.0D0
           XMIN=1000.0D0
           YMIN=1000.0D0
           SUMX=0.0D0
           SUMY=0.0D0
           DO 600 J=1,NRED
                X=XY(1,IHED,J)
                Y=XY(2,IHED,J)
                IF (X.EQ.0.AND.Y.EQ.0) GO TO 610
                SUMX=SUMX+X
                SUMY=SUMY+Y
                IF (NRED.EQ.1) GO TO 600
                IF (XMAX.LT.X) XMAX=X
                IF (XMIN.GT.X) XMIN=X
                IF (YMAX.LT.Y) YMAX=Y
                IF (YMIN.GT.Y) YMIN=Y
  600      CONTINUE
           IF (NRED.NE.1) GO TO 620
  610      XMIN=0.0D0
           YMIN=0.0D0
  620      J=NRED
           IF (J.EQ.0) J=1
           X=SUMX/J
           Y=SUMY/J
           XM=XMAX-XMIN
           YM=YMAX-YMIN
           IDPT=IDHED(IHED)
C
C  Correct Measured Coordinates for Film Shrinkage
C
           XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
           YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
C
           IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
           IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
           IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
           IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
```

```
      C
      C  Write Records for Triangulation Input to file: "img.dat"

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SUBROUTINE HEAD     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

            WRITE ( 9,1610) IDPT,XT,YT,IFRAM(IANS)
   690  CONTINUE
C
   700  icount=0
   710  write (*,*)' Re-do first fiducial'
        READ (11) DATA
        WRITE (*,*) CHAR(7)
C
C  DECODE data from CHARACTER to INTEGER
C
        if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
        READ (DATA, 20) IBUTT,IX,IY
        if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
           write (*,*)'  You blew it', ix, iy, ' vs.', isavex, isavey
           WRITE (*,*) CHAR(7)
           WRITE (*,*) CHAR(7)
           icount=icount+1
           if(icount.le.4) go to 710
           write(*, *)'No more tries...origin lost...going back to menu'
           WRITE (9,'(A8)') '********'
           go to 1
        endif
        PAUSE
        WRITE (9,'(A8)') '********'
        go to 1
C
   999  CALL CLEAR
        WRITE (12,'(A8)') '********'
        WRITE ( 8,*)CHAR(12)
        WRITE (10,*)CHAR(12)
C  FORMATTED OUTPUT FOR 132-COLUMN PAPER:
C
  1370 FORMAT (2I1,8X,3F10.3)
  1380 FORMAT (40X,'FIDUCIAL MEASUREMENTS OF FRAME ',A8//  36X,'ID',
     .  12X,'AVERAGE',13X,'MAX SPREAD'/48X,'X',9X,'Y',11X,'X',9X,'Y')
  1400 FORMAT (36X,'CALIBRATED FIDUCIAL COORDINATES OF FRAME ',A8//
     .                        46X, 'FID', 9X, 'X', 12X, 'Y' )
  1410 FORMAT (2X,I4,4X,2F10.4)
  1420 FORMAT (45X,I4,5X,F8.3,5X,F8.3)
  1440 FORMAT (2D20.10)
  1445 FORMAT (3D20.10)
  1450 FORMAT (//42X,SP,'CALIBRATED FOCAL LENGTH = ',F9.3,' mm.')
  1460 FORMAT (////51X,SP,'LENS DISTORTION'//51X,'RADIAL PARAMETERS'/31X
     .        'K0='D15.8D2,'  K1='D15.8D2,'  K2='D15.8D2/51X'K3='D15.8D2
     .        ,//:45X,'LENS DECENTRATION PARAMETERS'/31X,'J1= 'D15.8D2,
     .        '  J2= 'D15.8D2,' PHI= 'D15.8D2/)
  1470 FORMAT (I2)
  1480 FORMAT (2F10.3)
  1485 FORMAT (8X,'Calibrated Focal Length (CFL) in millimeters = ')
```

```
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SUBROUTINE HEAD     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

      549   1500 FORMAT (44X,2F13.3)
      550   1510 FORMAT (6X,I4,6F10.3)
      551   1516 FORMAT (A8,2X,SP,F10.3:,SS,2(F10.3),10X)
      552   1540 FORMAT (36X,I4,2X,2F10.3,2X,2F10.3)
      553   1550 FORMAT (//I38,'-PARAMETER RESIDUALS OF THE FIDUCIAL COORDINATES'//
      554      .                    43X, 'FID', 11X, 'X', 14X, 'Y' )
      555   1560 FORMAT (42X,I4,2F15.3)
      556   1570 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//22X,'ID',11X,
      557      .        'MEASURED',13X,'ADJUSTED',13X,'MAX SPREAD',11X,'FRAME'/
      558      .        34X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
      559   1575 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//38X,'ID',11X,
      560      .        'MEASURED',13X,'ADJUSTED'/50X,'X',9X,'Y',10X,'X',9X,'Y')
      561   1580 FORMAT (2X,A8,6F10.3)
      562   1600 FORMAT (18X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
      563   1605 FORMAT (34X,A8,2X,2F10.3,1X,2F10.3)
      564   1610 FORMAT (A8,2X,2F10.4,15X,'Photo ',A8)
      565  C
      566  C  FORMATTED OUTPUT FOR 80-COLUMN PAPER:
      567  C
      568   2380 FORMAT (20X,'Fiducial Measurements of Frame ',A8//  16X,'ID',12X,
      569      .  'Average',13X,'Max Spread'/28X,'X',9X,'Y',11X,'X',9X,'Y')
      570   2400 FORMAT (16X,'Calibrated Fiducial Coordinates of Frame ',A8//
      571      .                         26X, 'Fid', 9X, 'X', 12X, 'Y')
      572   2420 FORMAT (25X,I4,5X,F8.3,5X,F8.3)
      573   2450 FORMAT (//25X,SP,'Calibrated Focal Length = ',F9.3,' mm.')
      574   2460 FORMAT (////31X,SP,'Lens Distortion'//31X,'Radial Parameters'/11X
      575      .        'K0='D15.8D2,'  K1='D15.8D2,'  K2='D15.8D2/31X'K3='D15.8D2
      576      .        ,//:25X,'Lens Decentration Parameters'/11X,'J1= 'D15.8D2,
      577      .        '  J2= 'D15.8D2,' PHI= 'D15.8D2/)
      578   2500 FORMAT (24X,2F13.3)
      579   2540 FORMAT (16X,I4,2X,2F10.3,2X,2F10.3)
      580   2550 FORMAT (//I18,'-Parameter Residuals of the Fiducial Coordinates'//
      581      .                         23X, 'Fid', 11X, 'X', 14X, 'Y')
      582   2560 FORMAT (22X,I4,2F15.3)
      583   2570 FORMAT (//22X,'Plate Coordinates for Frame ',A8//'     ID',11X,
      584      .        'Measured',13X,'Adjusted',13X,'Max Spread',11X,'Frame'/
      585      .        17X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
      586   2575 FORMAT (//22X,'Plate Coordinates for Frame ',A8//18X,'ID',11X,
      587      .        'Measured',13X,'Adjusted'/30X,'X',9X,'Y',10X,'X',9X,'Y')
      588   2600 FORMAT (X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
      589   2605 FORMAT (14X,A8,2X,2F10.3,1X,2F10.3)
      590  C
      591        CALL BEEP
      592        CLOSE (8)
      593        CLOSE (9)
      594        CLOSE (10)
      595        END


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SUBROUTINE BODY     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

      596
      597        SUBROUTINE BODY
      598        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      599        CHARACTER   DATA*17, fn1*12, fn2*12, fn3*12, fn4*12
      600        CHARACTER*8 IFRAM(4),IDBOD(16), IDPT, DAY
      601        CHARACTER JTITLE*42
```

```
      COMMON /TITLEP/ JTITLE, I    Page
      INTEGER     IDFD(10), IBUTT,IFID,IRED,IX,IY
      REAL*8      XY(2,21,3), CALFID(2,10,2)
      logical     iflag
      EXTERNAL    SYSTEM
      INTRINSIC   CHAR,DFLOAT,  DSIN, DCOS, DSQRT
      COMMON      CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
      DATA IFRAM /'LfEyLfSh','RtEyLfSh', 'LfEyRtSh','RtEyRtSh'/
      DATA IDBOD /'Origin','Rib_Lf','Rib_Rt','SpineTop','SpineBot',
     .            'spine_bb','sternum',      'lf_shold','rt_shold',
     .            'ltp','rtp','ctp','lneckT','lneckB','rneckT','rneckB'/
      DATA CALFID/-190.190,-147.150, -77.030,-160.380,  77.220,-158.830,
     .             192.510,-146.442,-190.060,   5.760, 191.570,   5.990,
     .            -190.490, 157.980, -75.380, 146.070,  77.730, 147.920,
     .             191.520, 158.540,-193.950,-148.160, -80.380,-162.380,
     .              75.670,-164.310, 191.214,-148.961,-193.920,   5.010,
     .             192.310,   4.800,-193.010, 159.210, -80.050, 147.600,
     .              75.390, 144.880, 192.720, 158.520/
C ..............................................................
C       ALTEK DIGITIZER 4-BUTTON KEY CONTROL MEANINGS:
C                    #2:RED=ERROR-BACKUP
C       #4:BLUE=???                          #1:YELLOW=MISSING
C                #3:GREEN=FIDUCIAL or DATA POINT
C.....................................................................
      NBOD=16
      I    Page=0
      WRITE (*,*) ' Enter COMM Port number: '
      READ (*,*) Icmm
      icmm=icmm+48
      CALL SYSTEM ('MODE COM'//char(icmm)//':9600,0,7,2')
      OPEN (11,FILE ='COM'//char(icmm),   ACCESS='TRANSPARENT')
C
      WRITE (*,*) ' Enter HRV number: '
      READ (*,*) IHRV
      WRITE (*,*)
      WRITE (FN1, '(I4.4,''BODY.OUT'')')IHRV
      WRITE (FN2, '(I4.4,''body.132'')')IHRV
      WRITE (FN3, '(I4.4,''bimg.dat'')')IHRV
      WRITE (FN4, '(I4.4,''body.in'' )')IHRV
      OPEN ( 8,FILE =FN2)
      OPEN ( 9,FILE =FN3)
      OPEN (10,FILE =FN1)
      OPEN (12,FILE =FN4)
```



```
      CALL DATE (DAY)
      WRITE (JTITLE,
     .'('' HRV # '',I5.5,''       Date: '',A8,''   BODY(T-1)'')') IHRV, DAY
C  Read order of transformation
      WRITE (*,*) ' Enter number of parameters for shrinkage fit: '
      READ (*,*) IOPT1
      WRITE (*,*)
      units=25.4d-3
      SDX = 1.0
      SDY = 1.0
      IF (IOPT1.GT.6)IOPT1=8
      ICH3S=0
      IF (IOPT1.LE.3) THEN
           ICH3S=1
           IOPT1=3
```

```
      END IF
C      IOPT3=0
C  NRED indicates the number of replications of plate coordinates
      NRED=1
C
 1    WRITE (*,*) ' Enter 0 when finished'
      WRITE (*,*) ' Enter 1 if:  Left Eye View---Left Shoulder to Plate'
      WRITE (*,*) ' Enter 2 if: Right Eye View---Left Shoulder to Plate'
      WRITE (*,*) ' Enter 3 if:  Left Eye View--Right Shoulder to Plate'
      WRITE (*,*) ' Enter 4 if: Right Eye View--Right Shoulder to Plate'
      WRITE (*,*)
      READ (*,*) IANS
      if(ians.eq.0) go to 999
C
C  Input data for the Preprocessing Program:
C     3, 4, 5, 6, 8 in col. 1  Three(etc)-parameter transformation
C
C     Calibrated Fiducial Coordinates in   FORMAT (2X,I4,4X,2F10.4)
C
C     Radial Lens Distortion Function:
C       Coefficients FK0, FK1              FORMAT (2D20.10)
C       Coefficients FK2, FK3              FORMAT (2D20.10)
C
      CALL CLEAR
C
      FOCAL= -889.0D0
      CALL NEWPAG
      WRITE (8,1400) IFRAM(IANS)
      WRITE (10,2400)IFRAM(IANS)
      write (12, '(i1, 9x, 3f10.3)')iopt1, focal, sdx, sdy
C
C  Write Calibrated Fiducial Coordinates
C
      JFID=2
```



```
      do 8 ifid=1, 10
      WRITE ( 8,1420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
      WRITE (10,2420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
 8    WRITE (12,1410) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
      write (12, '(////)')
C
C  Read & Write Frame ID
C
      WRITE ( 9,1516) IFRAM(IANS), FOCAL, SDX, SDY
      WRITE (12,'(A8)') IFRAM(IANS)
      CALL NEWPAG
      WRITE ( 8,1380) IFRAM(IANS)
      WRITE (10,2380) IFRAM(IANS)
      NRED=1
C*******************************************************************************
C  Start major loop for digitizing x-rays:
      iflag=.true.
      DO 40 IRED=1,NRED
      IFID=1
 10   READ (11) DATA
      WRITE (*,*) CHAR(7)
C
C  DECODE data from CHARACTER to INTEGER
C
```

```
      718         if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
      719         READ (DATA, 20) IBUTT,IX,IY
      720    20   FORMAT (I1,1X,I6,1X,I6)
      721   C
      722   C  Interpret action to take based on which button was pressed:
      723         IF (IBUTT .EQ. 3) THEN
      724             XY(1,IFID,IRED)=IX*units
      725             XY(2,IFID,IRED)=IY*units
      726             WRITE (*,30) 'FIDUCIAL',IFID,XY(1,IFID,IRED),XY(2,IFID,IRED)
      727    30       FORMAT (' ',A,1X,I3,2X,F8.4,2X,F8.4)
      728             if(iflag)then
      729                 isavex=ix
      730                 isavey=iy
      731                 iflag=.false.
      732              endif
      733             IFID=IFID+1
      734         ELSEIF (IBUTT .EQ. 2) THEN
      735             IFID=IFID-1
      736             WRITE (*,*) 'Backing up one to FIDUCIAL # ',IFID
      737             WRITE (*,*) CHAR(7),CHAR(7)
      738         ELSEIF (IBUTT .EQ. 1) THEN
      739             XY(1,IFID,IRED)=-1.
      740             XY(2,IFID,IRED)=-1.
      741             WRITE (*,*) 'MISSING ', IFID
      742             IFID=IFID+1
```



```
      743         ELSE
      744             WRITE (*,*) 'Not an option. Redo'
      745         ENDIF
      746         IF (IFID .LE. 10) GO TO 10
      747    40   CONTINUE
      748   C
      749   C  Write out the raw data to raw.dat
      750         DO 60 IFID=1,10
      751         IF (XY(1,IFID,1).GT.0) WRITE (12,50) IFID,( XY(1,IFID,IRED),
      752        .        XY(2,IFID,IRED),IRED=1,NRED)
      753    50   FORMAT (6X,I4,S,6F10.3)
      754    60   CONTINUE
      755         WRITE (12,*)
      756   C
      757         IFID=0
      758         DO 200 K=1,10
      759   C
      760   C  Read measured fiducial coordinates
      761   C
      762              IFID=IFID+1
      763    80        IF (IFID.GT.10) GO TO 210
      764              IF (XY(1,IFID,1).LE.0) then
      765                 IFID=IFID+1
      766                 GO TO 80
      767              ENDIF
      768              KK=IFID
      769              XMAX=0.0D0
      770              YMAX=0.0D0
      771              XMIN=1000.0D0
      772              YMIN=1000.0D0
      773              SUMX=0.0D0
      774              SUMY=0.0D0
      775              DO 100 J=1,NRED
```

```
776                 X=XY(1,IFID,J)
777                 Y=XY(2,IFID,J)
778                 IF (X.EQ.0.AND.Y.EQ.0) GO TO 110
779                 SUMX=SUMX+X
780                 SUMY=SUMY+Y
781                 IF (NRED.EQ.1) GO TO 100
782                 IF (XMAX.LT.X) XMAX=X
783                 IF (XMIN.GT.X) XMIN=X
784                 IF (YMAX.LT.Y) YMAX=Y
785                 IF (YMIN.GT.Y) YMIN=Y
786   100       CONTINUE
787             IF (NRED.NE.1) GO TO 120
788   110       XMIN=0.0D0
789             YMIN=0.0D0
790   120       J=NRED
791             IF (J.EQ.0) J=1
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
792             XT=SUMX/J
793             YT=SUMY/J
794   C   Store averaged digitized coordinates
795             OBSCOR(1,K)=XT
796             OBSCOR(2,K)=YT
797             CALCOR(1,K)=CALFID(1,KK,JFID)
798             CALCOR(2,K)=CALFID(2,KK,JFID)
799             IDFD(K)=KK
800             WRITE ( 8,1540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
801             WRITE (10,2540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
802    200  CONTINUE
803   C
804   C  Compute the 3-Parameter Check Transformation.
805   C
806    210  NFID=K-1
807         ICH3S=1
808         CALL FOURP
809         WRITE (*,*)' 3-Parameter Check Transformation'
810         rmsx=0.
811         rmsy=0.
812         DO 220 I=1,NFID
813           X=OBSCOR(1,I)
814           Y=OBSCOR(2,I)
815          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
816          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
817           KK=IDFD(I)
818           WRITE ( *,2560) KK,XT,YT
819           rmsx=rmsx+xt*xt
820           rmsy=rmsy+yt*yt
821    220 CONTINUE
822         rmsx3=dsqrt(rmsx/nfid)
823         rmsy3=dsqrt(rmsy/nfid)
824         write (*,230)rmsx, rmsy
825    230  format (' rms= ',2f7.3)
826         WRITE (*,*)
827         WRITE (*,*)iopt1,'-Parameter Transformation'
828         rmsx=0.
829         rmsy=0.
830   C
831   C  Compute the Multi-Parameter Transformation.
832         ICH3=ICH3S
833         IF (IOPT1.LE.5) CALL FOURP
```

```
      IF (IOPT1.EQ.5) CALL FIVEP
      IF (IOPT1.EQ.6) CALL SIXP
      IF (IOPT1.EQ.8) CALL EIGHTP
      WRITE ( 8,1550) IOPT1
      WRITE (10,2550) IOPT1
C
C  Compute Residuals For the Fiducial Coordinates
C
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      DO 240 I=1,NFID
        X=OBSCOR(1,I)
        Y=OBSCOR(2,I)
       XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
       YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
        KK=IDFD(I)
        WRITE ( 8,1560) KK,XT,YT
        WRITE (10,2560) KK,XT,YT
        WRITE ( *,2560) KK,XT,YT
        rmsx=rmsx+xt*xt
        rmsy=rmsy+yt*yt
  240 CONTINUE
      rmsx=dsqrt(rmsx/nfid)
      rmsy=dsqrt(rmsy/nfid)
      write (*,230)rmsx, rmsy
      write( 8, 1545)rmsx, rmsy, rmsx3, rmsy3, del
      write(10, 2545)rmsx, rmsy, rmsx3, rmsy3, del
 1545 FORMAT(/43X,'RMS',2F15.3/43X,'RMS(CHECK)',F8.3, F15.3/
     .       /45X,'TRANSFORMATION PARAMETERS ARE:'/33X,2F11.6,F11.4,
     .                              2F11.6/33X,2F11.6,F11.4//)
 2545 FORMAT(/23X,'Rms',2F15.3/23X,'Rms(check)',F8.3, F15.3/
     .       /25X,'Transformation Parameters Are:'/13X,2F11.6,F11.4,
     .                              2F11.6/13X,2F11.6,F11.4)
      CALL NEWPAG
      IF (NRED .GT. 1) WRITE (8,1570) IFRAM(IANS)
      IF (NRED .GT. 1) WRITE (10,2570)IFRAM(IANS)
      IF (NRED .EQ. 1) WRITE (8,1575) IFRAM(IANS)
      IF (NRED .EQ. 1) WRITE (10,2575)IFRAM(IANS)
      PAUSE
C*********************************************************************
C
C  Compute the Averaged Coordinates of the HRV body
C
  500 DO 560 IRED=1,NRED
      IBOD=1
  550 READ (11) DATA
      WRITE (*,*) CHAR(7)
C
C  DECODE data from CHARACTER to INTEGER
C
      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
      READ (DATA, 20) IBUTT,IX,IY
C
C  Interpret action to take based on which button was pressed:
      IF (IBUTT .EQ. 3) THEN
          XY(1,IBOD,IRED)=IX*units
          XY(2,IBOD,IRED)=IY*units
          WRITE (*,555)IDBOD(IBOD),XY(1,IBOD,IRED),XY(2,IBOD,IRED)
  555     FORMAT (A10,2X,F8.4,2X,F8.4)
```

```
      891            IBOD=IBOD+1
      892         ELSEIF (IBUTT .EQ. 2) THEN
      893            IBOD=IBOD-1
      894            WRITE (*,*) 'Backing up one to ', IDBOD(IBOD)
      895            WRITE (*,*) CHAR(7),CHAR(7)
      896         ELSEIF (IBUTT .EQ. 1) THEN
      897            XY(1,IBOD,IRED)=-1.
      898            XY(2,IBOD,IRED)=-1.
      899            WRITE (*,*) 'MISSING ', IDBOD(IBOD)
      900            IBOD=IBOD+1
      901         ELSE
      902            WRITE (*,*) 'Not an option. Redo'
      903         ENDIF
      904         IF (IBOD .LE. NBOD) GO TO 550
      905   560   CONTINUE
      906   C
      907         DO 580 IBOD=1,NBOD
      908            IF (XY(1,IBOD,1).GT.0) WRITE (12,270) IDBOD(IBOD),
      909        .           (XY(1,IBOD,IRED),XY(2,IBOD,IRED),IRED=1,NRED)
      910   270     FORMAT (2X,A8,1X,S,6(F9.4,1X))
      911   580   CONTINUE
      912         WRITE (12,*)
      913   C
      914         IBOD=0
      915         DO 690 K=1,NBOD
      916   C
      917   C  Process measured body coordinates
      918   C
      919            IBOD=IBOD+1
      920   590      IF (IBOD.GT.NBOD) GO TO 700
      921            IF (XY(1,IBOD,1).LE.0) then
      922               IBOD=IBOD+1
      923               GO TO 590
      924            ENDIF
      925            KK=IBOD
      926            XMAX=0.0D0
      927            YMAX=0.0D0
      928            XMIN=1000.0D0
      929            YMIN=1000.0D0
      930            SUMX=0.0D0
      931            SUMY=0.0D0
      932            DO 600 J=1,NRED
      933                 X=XY(1,IBOD,J)
      934                 Y=XY(2,IBOD,J)
      935                 IF (X.EQ.0.AND.Y.EQ.0) GO TO 610
      936                 SUMX=SUMX+X
      937                 SUMY=SUMY+Y
      938                 IF (NRED.EQ.1) GO TO 600
      939                 IF (XMAX.LT.X) XMAX=X
```



```
      940                 IF (XMIN.GT.X) XMIN=X
      941                 IF (YMAX.LT.Y) YMAX=Y
      942                 IF (YMIN.GT.Y) YMIN=Y
```

```
 600       CONTINUE
           IF (NRED.NE.1) GO TO 620
 610       XMIN=0.0D0
           YMIN=0.0D0
 620       J=NRED
           IF (J.EQ.0) J=1
           X=SUMX/J
           Y=SUMY/J
           XM=XMAX-XMIN
           YM=YMAX-YMIN
           IDPT=IDBOD(IBOD)
C
C  Correct Measured Coordinates for Film Shrinkage
C
           XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
           YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
C
           IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
           IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
           IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
           IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
C
C  Write Records for Triangulation Input to file: "img.dat"
             WRITE ( 9,1610) IDPT,XT,YT,IFRAM(IANS)
 690  CONTINUE
C
 700  icount=0
 710  write (*,*)' Re-do first fiducial'
      READ (11) DATA
      WRITE (*,*) CHAR(7)
C
C  DECODE data from CHARACTER to INTEGER
C
      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
      READ (DATA, 20) IBUTT,IX,IY
      if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
         write (*,*)'  You blew it', ix, iy, ' vs.', isavex, isavey
         WRITE (*,*) CHAR(7)
         WRITE (*,*) CHAR(7)
         icount=icount+1
         if(icount.le.4) go to 710
         write(*, *)'No more tries...origin lost...going back to menu'
         WRITE (9,'(A8)') '********'
         go to 1
      endif
      PAUSE
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      WRITE (9,'(A8)') '********'
      go to 1
C
 999  CALL CLEAR
      WRITE (12,'(A8)') '********'
      WRITE ( 8,*)CHAR(12)
      WRITE (10,*)CHAR(12)
C  FORMATTED OUTPUT FOR 132-COLUMN PAPER:
C
 1370 FORMAT (2I1,8X,3F10.3)
 1380 FORMAT (40X,'FIDUCIAL MEASUREMENTS OF FRAME ',A8//  36X,'ID',
     .  12X,'AVERAGE',13X,'MAX SPREAD'/48X,'X',9X,'Y',11X,'X',9X,'Y')
```

```
1001   1400 FORMAT (36X,'CALIBRATED FIDUCIAL COORDINATES OF FRAME ',A8//
1002       .                    46X, 'FID', 9X, 'X', 12X, 'Y' )
1003   1410 FORMAT (2X,I4,4X,2F10.4)
1004   1420 FORMAT (45X,I4,5X,F8.3,5X,F8.3)
1005   1440 FORMAT (2D20.10)
1006   1445 FORMAT (3D20.10)
1007   1450 FORMAT (//42X,SP,'CALIBRATED FOCAL LENGTH = ',F9.3,' mm.')
1008   1460 FORMAT (////51X,SP,'LENS DISTORTION'//51X,'RADIAL PARAMETERS'/31X
1009       .        'K0='D15.8D2,'  K1='D15.8D2,'  K2='D15.8D2/51X'K3='D15.8D2
1010       .        ,//:45X,'LENS DECENTRATION PARAMETERS'/31X,'J1= 'D15.8D2,
1011       .        '  J2= 'D15.8D2,' PHI= 'D15.8D2/)
1012   1470 FORMAT (I2)
1013   1480 FORMAT (2F10.3)
1014   1485 FORMAT (8X,'Calibrated Focal Length (CFL) in millimeters = ')
1015   1500 FORMAT (44X,2F13.3)
1016   1510 FORMAT (6X,I4,6F10.3)
1017   1516 FORMAT (A8,2X,SP,F10.3:,SS,2(F10.3),10X)
1018   1540 FORMAT (36X,I4,2X,2F10.3,2X,2F10.3)
1019   1550 FORMAT (//I38,'-PARAMETER RESIDUALS OF THE FIDUCIAL COORDINATES'//
1020       .                    43X, 'FID', 11X, 'X', 14X, 'Y' )
1021   1560 FORMAT (42X,I4,2F15.3)
1022   1570 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//22X,'ID',11X,
1023       .        'MEASURED',13X,'ADJUSTED',13X,'MAX SPREAD',11X,'FRAME'/
1024       .        34X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
1025   1575 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//38X,'ID',11X,
1026       .        'MEASURED',13X,'ADJUSTED'/50X,'X',9X,'Y',10X,'X',9X,'Y')
1027   1580 FORMAT (2X,A8,6F10.3)
1028   1600 FORMAT (18X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
1029   1605 FORMAT (34X,A8,2X,2F10.3,1X,2F10.3)
1030   1610 FORMAT (A8,2X,2F10.4,15X,'Photo ',A8)
1031   C
1032   C  FORMATTED OUTPUT FOR 80-COLUMN PAPER:
1033   C
1034    2380 FORMAT (20X,'Fiducial Measurements of Frame ',A8//  16X,'ID',12X,
1035       .  'Average',13X,'Max Spread'/28X,'X',9X,'Y',11X,'X',9X,'Y')
1036   2400 FORMAT (16X,'Calibrated Fiducial Coordinates of Frame ',A8//
1037       .                        26X, 'Fid', 9X, 'X', 12X, 'Y')
```

```
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SUBROUTINE BODY     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing
```

```
1038   2420 FORMAT (25X,I4,5X,F8.3,5X,F8.3)
1039   2450 FORMAT (//25X,SP,'Calibrated Focal Length = ',F9.3,' mm.')
1040   2460 FORMAT (////31X,SP,'Lens Distortion'//31X,'Radial Parameters'/11X
1041       .        'K0='D15.8D2,'  K1='D15.8D2,'  K2='D15.8D2/31X'K3='D15.8D2
1042       .        ,//:25X,'Lens Decentration Parameters'/11X,'J1= 'D15.8D2,
1043       .        '  J2= 'D15.8D2,' PHI= 'D15.8D2/)
1044   2500 FORMAT (24X,2F13.3)
1045   2540 FORMAT (16X,I4,2X,2F10.3,2X,2F10.3)
1046   2550 FORMAT (//I18,'-Parameter Residuals of the Fiducial Coordinates'//
1047       .                        23X, 'Fid', 11X, 'X', 14X, 'Y')
1048   2560 FORMAT (22X,I4,2F15.3)
1049   2570 FORMAT (//22X,'Plate Coordinates for Frame ',A8//'     ID',11X,
1050       .        'Measured',13X,'Adjusted',13X,'Max Spread',11X,'Frame'/
1051       .        17X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
1052   2575 FORMAT (//22X,'Plate Coordinates for Frame ',A8//18X,'ID',11X,
1053       .        'Measured',13X,'Adjusted'/30X,'X',9X,'Y',10X,'X',9X,'Y')
1054   2600 FORMAT (X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
1055   2605 FORMAT (14X,A8,2X,2F10.3,1X,2F10.3)
1056   C
1057         CALL BEEP
1058         CLOSE (8)
```

```
      CLOSE (9)
      CLOSE (10)
      END
```


SUBROUTINE FOURP   Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      SUBROUTINE FOURP
C
C  Calculate the 3 or 4 Parameter Transformation Between an Exact Set
C       of Data and a Corresponding Set of Measured Data.
C
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      INTRINSIC DSQRT
      DIMENSION AM(2,4), CM(2)
      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
C
      DO 1010 I=1,4
           DO 1010 J=1,5
           EQN(I,J)=0.0D0
 1010 CONTINUE
      AM(1,3)=1.0D0
      AM(1,4)=0.0D0
      AM(2,3)=0.0D0
      AM(2,4)=1.0D0
      DO 1030 I=1,NFID
           AM(1,1)=OBSCOR(1,I)
           AM(1,2)=OBSCOR(2,I)
           AM(2,1)=AM(1,2)
           AM(2,2)=-AM(1,1)
           CM(1)=CALCOR(1,I)
           CM(2)=CALCOR(2,I)
           DO 1020 J=1,4
                DO 1020 K=1,2
                EQN(J,5)=EQN(J,5)+AM(K,J)*CM(K)
                DO 1020 L=1,4
                EQN(J,L)=EQN(J,L)+AM(K,J)*AM(K,L)
 1020      CONTINUE
 1030 CONTINUE
      CALL LINSOL(4)
      IF (ICH3.EQ.0) GO TO 1060
C
C  If ICH3<>0 Transform the 4-param to a 3-param
C
      SCALE=EQN(1,5)**2+EQN(2,5)**2
      SCALE=DSQRT(SCALE)
      EQN(1,5)=EQN(1,5)/SCALE
      EQN(2,5)=EQN(2,5)/SCALE
      SUM1=0.0D0
      SUM2=0.0D0
      DO 1050 I=1,NFID
           X=OBSCOR(1,I)
           Y=OBSCOR(2,I)
           SUM1=SUM1+CALCOR(1,I)-EQN(1,5)*X-EQN(2,5)*Y
           SUM2=SUM2+CALCOR(2,I)+EQN(2,5)*X-EQN(1,5)*Y
```

```
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SUBROUTINE FOURP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1111   1050 CONTINUE
     1112        EQN(3,5)=SUM1/NFID
     1113        EQN(4,5)=SUM2/NFID
     1114  C
     1115  C  Form transformation parameters vector
     1116  C
     1117   1060 DEL(1)=EQN(1,5)
     1118        DEL(2)=EQN(2,5)
     1119        DEL(3)=EQN(3,5)
     1120        DEL(4)=0.0D0
     1121        DEL(5)=0.0D0
     1122        DEL(6)=-DEL(2)
     1123        DEL(7)=DEL(1)
     1124        DEL(8)=EQN(4,5)
     1125        END


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SUBROUTINE FIVEP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1126
     1127        SUBROUTINE FIVEP
     1128  C
     1129  C  Calculate the FIVE Parameter Transformation Between an Exact Set
     1130  C       of Data and a Corresponding Set of Measured Data.
     1131  C
     1132        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
     1133        INTRINSIC DSIN, DCOS, DABS
     1134        DIMENSION B(2,5),C(2),CV(5),PAR(5)
     1135        COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
     1136  C
     1137        PAR(1)=DSQRT(DEL(1)**2+DEL(2)**2)
     1138        PAR(2)=PAR(1)
     1139        PAR(3)=DATAN2(DEL(2),DEL(1))
     1140        PAR(4)=DEL(3)
     1141        PAR(5)=DEL(8)
     1142        B(1,2)=0.0D0
     1143        B(1,5)=0.0D0
     1144        B(2,1)=0.0D0
     1145        B(2,4)=0.0D0
     1146        DO 30 II=1,10
     1147        DO 2 I=1, 5
     1148          CV(I)=0.0D0
     1149          DO 2 J=1, 5
     1150   2    EQN(I, J)=0.0D0
     1151        DO 10 I=1,NFID
     1152             B(1,4)=PAR(1)
     1153             B(2,5)=PAR(2)
     1154             SINT=DSIN(PAR(3))
     1155             COST=DCOS(PAR(3))
     1156             X=OBSCOR(1,I)
     1157             Y=OBSCOR(2,I)
     1158             C1=-X*SINT+Y*COST
     1159             C2= X*COST+Y*SINT
     1160             B(1,1)=C2*PAR(1)
     1161             B(1,3)=C1*PAR(1)**2
     1162             B(2,2)=C1*PAR(2)
     1163             B(2,3)=-C2*PAR(2)**2
```

```
1164              C(1)=PAR(1)*(CALCOR(1,I)-PAR(1)*C2-PAR(4))
1165              C(2)=PAR(2)*(CALCOR(2,I)-PAR(2)*C1-PAR(5))
1166              DO 10 J=1,5
1167              DO 10 K=1,2
1168                   CV(J)=CV(J)+B(K,J)*C(K)
1169              DO 10 L=1,5
1170                   EQN(J,L)=EQN(J,L)+B(K,J)*B(K,L)
1171    10        CONTINUE
1172    C
1173    C   Solve normal equations
1174    C
1175          CALL LINSOL(5)
```

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SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1176          DO 15 J=1, 5
1177    15    PAR(J)=PAR(J)+EQN(J, 6)
1178    C
1179    C   Test for convergence
1180    C
1181          DO 20 J=1, 5
1182          C1=DABS(EQN(J, 6))
1183          EPSLN=1.0D-6
1184          IF(J.GT.3)EPSLN=1.0D-4
1185          IF(C1.GT.EPSLN)GO TO 30
1186    20    CONTINUE
1187          GO TO 40
1188    30    CONTINUE
1189          CALL CLEAR
1190          CALL BEEP
1191          WRITE(*,*)' Error in FIVEP'
1192          STOP
1193    C
1194    C   Form transformation parameters vector
1195    C
1196    40    SINT=DSIN(PAR(3))
1197          COST=DCOS(PAR(3))
1198          DEL(1)=PAR(1)*COST
1199          DEL(2)=PAR(1)*SINT
1200          DEL(3)=PAR(4)
1201          DEL(4)=0.0D0
1202          DEL(5)=0.0D0
1203          DEL(6)=-PAR(2)*SINT
1204          DEL(7)=PAR(2)*COST
1205          DEL(8)=PAR(5)
1206          END
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1207
1208          SUBROUTINE SIXP
1209    C
1210    C  Calculate the SIX Parameter Transformation Between an Exact Set
1211    C       of Data and a Corresponding Set of Measured Data.
1212    C
1213          IMPLICIT DOUBLE PRECISION (A-H,O-Z)
```

```
      DIMENSION ANS(2,3), CCC(3,3), DDD(3,2), RRR(2,2), ERR(2)
      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
C
C  Zero Normal Equation Area.
C
      DO 1010 I=1,2
           DO 1010 J=1,3
           CCC(I,J)=0.0D0
           DDD(J,I)=0.0D0
 1010 CONTINUE
C
C  Compute Normal Equations
C
      DO 1020 I=1,NFID
           DO 1020 J=1,2
           CCC(J,3)=CCC(J,3)+CALCOR(J,I)
           DDD(3,J)=DDD(3,J)+OBSCOR(J,I)
           DO 1020 K=1,2
           CCC(J,K)=CCC(J,K)+CALCOR(J,I)*CALCOR(K,I)
           DDD(J,K)=DDD(J,K)+CALCOR(J,I)*OBSCOR(K,I)
 1020 CONTINUE
      CCC(3,1)=CCC(1,3)
      CCC(3,2)=CCC(2,3)
      CCC(3,3)=NFID
C
C  Compute Inverse of Normal Matrix.
C
      IGGY=3
      CALL INVERT (CCC,IGGY,DET)
C
C  Compute the Transformation Parameters
C
      DO 1030 I=1,2
           DO 1030 J=1,3
           ANS(I,J)=0.0D0
           DO 1030 K=1,3
 1030      ANS(I,J)=ANS(I,J)+CCC(J,K)*DDD(K,I)
C
C  Calculate the Transformation from Measured Data to Exact Data.
C
      DO 1040 I=1,2
           DO 1040 J=1,2
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
 1040      RRR(I,J)=ANS(I,J)
      IGGY=2
      CALL INVERT (RRR,IGGY,DET)
      DO 1050 I=1,2
           DO 1050 J=1,2
 1050      ANS(I,J)=RRR(I,J)
      DO 1060 I=1,2
 1060      ERR(I)=-ANS(I,1)*ANS(1,3)-ANS(I,2)*ANS(2,3)
      DO 1070 I=1,2
 1070      ANS(I,3)=ERR(I)
C
C  Form transformation parameters vector
C
      DEL(1)=ANS(1,1)
      DEL(2)=ANS(1,2)
      DEL(3)=ANS(1,3)
```

```
      DEL(4)=0.0D0
      DEL(5)=0.0D0
      DEL(6)=ANS(2,1)
      DEL(7)=ANS(2,2)
      DEL(8)=ANS(2,3)
      END
```

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SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      SUBROUTINE EIGHTP
C
C  Calculate the EIGHT Parameter Transformation Between an Exact Set
C       of Data and a Corresponding Set of Measured Data.
C
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      INTRINSIC DABS
      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
      real*8    tem(8)
C
C  Zero the matrix of linear equations EQN
C
      DO 1 I=1,8
           del(i)=0.0d0
           DO 1 J=1,9
 1    EQN(I,J)=0.0D0
C
C  Compute approximate values for the transformation parameters
C
      DO 10 I=1,NFID
 10   CALL ACCAPR (CALCOR(1,I),CALCOR(2,I),OBSCOR(1,I),OBSCOR(2,I))
      N=8
      call invert(eqn, n, d)
      do 15 i=1, 8
      do 15 j=1, 8
 15   del(i)=del(i)+eqn(i, j)*eqn(j, 9)
C
C  Compute the transformation parameters by least squares
C
      DO 50 M=1,5
C
C  Zero the normal equations
C
           DO 18 I=1,8
              tem(i)=0.0d0
              DO 18 J=1,9
 18      EQN(I,J)=0.0D0
C
C  Form the normal equations
C
           DO 20 I=1,NFID
 20      CALL ACCNEQ (CALCOR(1,I),CALCOR(2,I),OBSCOR(1,I),OBSCOR(2,I))
C
C  Solve the normal equations
C
           call invert(eqn, n, d)
           do 25 i=1, 8
              do 25 j=1, 8
```

```
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SUBROUTINE EIGHTP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1327   25      tem(i)=tem(i)+eqn(i, j)*eqn(j, 9)
     1328  C
     1329  C  Correct the approximate values of the transformation parameters
     1330  C
     1331           do 30 i=1, 8
     1332   30      del(i)=del(i)+tem(i)
     1333  C
     1334  C  Test the solution for convergence
     1335  C
     1336           DO 40 I=1,8
     1337              D=DABS(DEL(I)/(DEL(I)-tem(I))-1.0)
     1338              IF (D.GT..001D0) GO TO 50
     1339   40      CONTINUE
     1340           RETURN
     1341   50   CONTINUE
     1342        END


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SUBROUTINE LINSOL     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1343
     1344        SUBROUTINE LINSOL(NPAR)
     1345  C
     1346  C  Solution of (NPAR) linear equations in (NPAR) unknowns.
     1347  C
     1348        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
     1349        COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
     1350  C
     1351        DO 1040 K=1,NPAR
     1352             M=NPAR+1
     1353             DO 1010 J=K,NPAR+1
     1354                  EQN(K,M)=EQN(K,M)/EQN(K,K)
     1355   1010           M=M-1
     1356             DO 1030 I=1,NPAR
     1357                  IF (I.EQ.K) GO TO 1030
     1358                  M=NPAR+1
     1359                  DO 1020 L=K,NPAR+1
     1360                       EQN(I,M)=EQN(I,M)-EQN(I,K)*EQN(K,M)
     1361   1020                M=M-1
     1362   1030      CONTINUE
     1363   1040 CONTINUE
     1364  C
     1365        END


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SUBROUTINE ACCAPR     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1366
     1367        SUBROUTINE ACCAPR (XG,YG,XP,YP)
     1368  C
     1369  C  Evaluate the contribution of one point to the 8 by 9 matrix of
     1370  C  normal equations for computation of approximate values of the
     1371  C  eight-parameter film shrinkage transformation.
```

```
1372  C
1373  C          XG:  Calibrated X Fiducial coordinate
1374  C          YG:  Calibrated Y Fiducial coordinate
1375  C          XP:  Observed X Fiducial coordinate
1376  C          YP:  Observed Y Fiducial coordinate
1377  C         EQN:  8 X 8 Coefficient matrix of the Normal Equation
1378  C               with the vector of constants in column 9.
1379  C
1380        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1381        DIMENSION AM(2,8), BM(2)
1382        COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1383  C
1384        AM(1,1)=XP
1385        AM(1,2)=YP
1386        AM(1,3)=1.0D0
1387        AM(1,4)=-XG*XP
1388        AM(1,5)=-XG*YP
1389        AM(1,6)=0.0D0
1390        AM(1,7)=0.0D0
1391        AM(1,8)=0.0D0
1392        AM(2,1)=0.0D0
1393        AM(2,2)=0.0D0
1394        AM(2,3)=0.0D0
1395        AM(2,4)=-XP*YG
1396        AM(2,5)=-YP*YG
1397        AM(2,6)=XP
1398        AM(2,7)=YP
1399        AM(2,8)=1.0D0
1400        BM(1)=XG
1401        BM(2)=YG
1402        DO 1010 I=1,8
1403             DO 1010 J=1,8
1404             DO 1010 K=1,2
1405   1010      EQN(I,J)=EQN(I,J)+AM(K,I)*AM(K,J)
1406        DO 1020 I=1,8
1407             DO 1020 J=1,2
1408   1020      EQN(I,9)=EQN(I,9)+AM(J,I)*BM(J)
1409  C
1410        END
```

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SUBROUTINE ACCNEQ Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1411
1412        SUBROUTINE ACCNEQ (XG,YG,XP,YP)
1413  C
1414  C  Evaluate the contribution of one point to the normal equation
1415  C  required for Subroutine EIGHT.  The normal equations are
1416  C  required to compute corrections to the last estimate of the
1417  C  eight transformation parameters.  This is called once for each
1418  C  point.
1419  C
1420  C          XG:  Calibrated X Fiducial coordinate
1421  C          YG:  Calibrated Y Fiducial coordinate
1422  C          XP:    Observed X Fiducial coordinate
1423  C          YP:    Observed Y Fiducial coordinate
1424  C         EQN:  8 X 8 Coefficient matrix of the Normal Equation
1425  C               with the vector of constants in column 9.
1426  C
1427  C
1428        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1429        DIMENSION AM(2,2), BM(2,8), CM(2), AMM(2,2)
```

```
      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
C
      AM(1,1)=DEL(1)-XG*DEL(4)
      AM(1,2)=DEL(2)-XG*DEL(5)
      AM(2,1)=DEL(6)-YG*DEL(4)
      AM(2,2)=DEL(7)-YG*DEL(5)
      BM(1,1)=XP
      BM(1,2)=YP
      BM(1,3)=1.0D0
      BM(1,4)=-XP*XG
      BM(1,5)=-YP*XG
      BM(1,6)=0.0D0
      BM(1,7)=0.0D0
      BM(1,8)=0.0D0
      BM(2,1)=0.0D0
      BM(2,2)=0.0D0
      BM(2,3)=0.0D0
      BM(2,4)=-XP*YG
      BM(2,5)=-YP*YG
      BM(2,6)=XP
      BM(2,7)=YP
      BM(2,8)=1.0D0
      CM(1)=XP*AM(1,1)+YP*AM(1,2)+DEL(3)-XG
      CM(2)=XP*AM(2,1)+YP*AM(2,2)+DEL(8)-YG
C
C  Form modified covariance matrix AMM
C
      DO 10 I=1,2
           DO 10 J=1,2
           AMM(I,J)=0.0D0
```

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SUBROUTINE ACCNEQ Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
           DO 10 K=1,2
           AMM(I,J)=AMM(I,J)+AM(I,K)*AM(J,K)
10    CONTINUE
      D=AMM(1,1)*AMM(2,2)-AMM(1,2)*AMM(2,1)
      AM(1,1)= AMM(2,2)/D
      AM(2,2)= AMM(1,1)/D
      AM(1,2)=-AMM(2,1)/D
      AM(2,1)= AMM(1,2)
C
C  Form normal equations
C
      DO 20 I=1,8
           DO 20 J=1,8
           DO 20 K=1,2
           DO 20 L=1,2
           EQN(I,J)=EQN(I,J)+BM(K,I)*AM(K,L)*BM(L,J)
20    CONTINUE
      DO 30 I=1,8
           DO 30 K=1,2
           DO 30 L=1,2
           EQN(I,9)=EQN(I,9)-BM(K,I)*AM(K,L)*CM(L)
30    CONTINUE
      END
```

```
F77L - Lahey FORTRAN 77, Version 5.01    20 Apr 93 14:51:12                    Page   36
SUBROUTINE INVERT     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

1483
1484
1485          SUBROUTINE INVERT (A,N,D)
1486    C
1487    C  Find the Inverse of a Matrix by the Gaussian Elimination Method.
1488    C  A: Array in which the matrix to be inverted is located.
1489    C     The routine will search for the largest non-singular matrix in
1490    C     the array A and invert it & return it in the same locations of A.
1491    C  N: The first dimension of A. It must be a variable in the call list.
1492    C     The rank of largest matrix contained in A will be returned in N.
1493    C  D: The determinant of the largest non-singular matrix in A.
1494    C  L & M: Vectors of dimension N used temporarily.
1495    C
1496    C
1497          IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1498          INTRINSIC DABS
1499          DIMENSION A(64), L(8), M(8)
1500    C
1501    C  Initiate the continued product of pivots becoming the determinant.
1502    C
1503          D=1.0D0
1504    C
1505    C  Initiate the counter which contains the rank of the matrix.
1506    C
1507          KSAVE=0
1508    C
1509    C  Start the main elimination loop.
1510    C
1511          DO 1090 K=1,N
1512    C
1513    C  Search for the largest element
1514    C
1515                L(K)=K
1516                M(K)=K
1517                KK=K+N*(K-1)
1518                BIGA=A(KK)
1519                DO 1010 I=K,N
1520                     DO 1010 J=K,N
1521                     IJ=I+N*(J-1)
1522                     IF (DABS(BIGA).GE.DABS(A(IJ))) GO TO 1010
1523                     BIGA=A(IJ)
1524                     L(K)=I
1525                     M(K)=J
1526     1010       CONTINUE
1527    C
1528    C  Largest element of zero means the largest matrix in A is less than N.
1529    C
1530                IF (BIGA.EQ.0) GO TO 1100
1531    C
1532    C  Interchange rows

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SUBROUTINE INVERT     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

1533    C
1534                J=L(K)
1535                KSAVE=K
1536                IF (L(K).LE.K) GO TO 1030
```

```
1537              DO 1020 I=1,N
1538                   KI=K+N*(I-1)
1539                   JI=J+N*(I-1)
1540                   tem=-a(ki)
1541                   a(ki)=a(ji)
1542                   a(ji)=tem
1543    1020      CONTINUE
1544    C
1545    C  Interchange columns.
1546    C
1547    1030      I=M(K)
1548              IF (M(K).LE.K) GO TO 1050
1549              DO 1040 J=1,N
1550                   JK=J+N*(K-1)
1551                   JI=J+N*(I-1)
1552                   tem=-a(jk)
1553                   a(jk)=a(ji)
1554                   a(ji)=tem
1555    1040      CONTINUE
1556    C
1557    C  Divide column by minus pivot
1558    C
1559    1050      DO 1060 I=1,N
1560                   IF (I.EQ.K) GO TO 1060
1561                   IK=I+N*(K-1)
1562                   A(IK)=A(IK)/(-A(KK))
1563    1060      CONTINUE
1564    C
1565    C  Reduce matrix
1566    C
1567              DO 1070 I=1,N
1568                   DO 1070 J=1,N
1569                   IF (I.EQ.K.OR.J.EQ.K) GO TO 1070
1570                   IJ=I+N*(J-1)
1571                   IK=I+N*(K-1)
1572                   KJ=K+N*(J-1)
1573                   A(IJ)=A(IK)*A(KJ)+A(IJ)
1574    1070      CONTINUE
1575    C
1576    C  Divide row by pivot
1577    C
1578              DO 1080 J=1,N
1579                   IF (J.EQ.K) GO TO 1080
1580                   KJ=K+N*(J-1)
1581                   A(KJ)=A(KJ)/A(KK)
```

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SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1582    1080      CONTINUE
1583    C
1584    C  Continued product of pivots
1585    C
1586              D=D*A(KK)
1587              A(KK)=1.0D0/A(KK)
1588    1090 CONTINUE
1589    C
1590    C  Final row and column interchange
1591    C
1592    1100 K=KSAVE+1
1593    1110 K=K-1
```

```
1594         IF (K.LE.0) GO TO 1150
1595   C
1596   C  Restore columns.
1597   C
1598         I=L(K)
1599         IF (I.LE.K) GO TO 1130
1600         DO 1120 J=1,N
1601              JK=J+N*(K-1)
1602              JI=J+N*(I-1)
1603              tem=A(jk)
1604              A(JK)=-A(JI)
1605              A(ji)=tem
1606    1120 continue
1607   C
1608   C  Restore rows.
1609   C
1610    1130 J=M(K)
1611         IF (J.LE.K) GO TO 1110
1612         DO 1140 I=1,N
1613              KI=K+N*(I-1)
1614              JI=J+N*(I-1)
1615              tem=A(ki)
1616              A(KI)=-A(JI)
1617              A(ji)=tem
1618    1140 continue
1619         GO TO 1110
1620   C
1621   C  Set the rank of the matrix and return to the calling routine.
1622   C
1623    1150 RETURN
1624         END
```

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SUBROUTINE NEWPAG Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1625
1626         SUBROUTINE NEWPAG
1627   C
1628   C  Generate page titles for GIANT system, insert Form Feed whether the
1629   C  FORTRAN compiler supports it or not.  (Hewlett-Packard 9000 doesn't)
1630   C
1631         INTRINSIC CHAR
1632         CHARACTER FF*1, JTITLE*42
1633         COMMON /TITLEP/ JTITLE, I    Page
1634   C
1635         FF=CHAR(12)
1636         I    Page=I    Page+1
1637         IF (I    Page .GT. 0) THEN
1638            WRITE ( 8,1010) FF,JTITLE,I    Page
1639            WRITE (10,1020) FF,I    Page,JTITLE
1640         ENDIF
1641    1010 FORMAT(A,' NBDL H-P UNIX GIANT X-PREP :',3X,A80,3X,'    Page',I5//)
1642    1020 FORMAT(A,' NBDL H-P UNIX GIANT X-PREP :',38X,'    Page',I3/1X,A42/)
1643         END
```

```
F77L - Lahey FORTRAN 77, Version 5.01    20 Apr 93 14:51:12                    Page   40
SUBROUTINE BEEP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1644
     1645         SUBROUTINE BEEP
     1646  C
     1647  C  This routine causes a "beep" sound when called. (ANSI terminals)
     1648  C
     1649         CHARACTER*1 BEEEP
     1650         INTRINSIC CHAR
     1651         BEEEP=CHAR(7)
     1652         WRITE (*,'(1X,A1)') BEEEP
     1653         END


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SUBROUTINE CLEAR     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1654
     1655         SUBROUTINE CLEAR
     1656         CALL CLR
     1657         CALL TOPLFT
     1658         CALL CURDWN (8)
     1659         END


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SUBROUTINE CLR     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1660
     1661         SUBROUTINE CLR
     1662  C
     1663  C  This routine erases the screen and the cursor goes to the home positi
     1664  C  (ANSI)      STRING = ESC [ 2 J
     1665  C
     1666         CHARACTER*1 ESC,BKT,TWO,J,STRING*4
     1667         INTRINSIC CHAR
     1668         ESC=CHAR(27)
     1669         BKT=CHAR(91)
     1670         TWO=CHAR(50)
     1671         J=CHAR(74)
     1672         STRING=ESC//BKT//TWO//J
     1673         WRITE (*,'(1X,A4)') STRING
     1674         END


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SUBROUTINE CURDWN     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

     1675
     1676         SUBROUTINE CURDWN (IROW)
     1677  C
     1678  C  This routine moves the cursor down IROW lines without changing column
     1679  C    (ignored if the cursor is already at the bottom of the screen)
     1680  C    (ANSI)
```

```
1681  C
1682        CHARACTER*1 ESC,BKT,B
1683        CHARACTER*2 ESCBKT
1684        INTRINSIC CHAR
1685        ESC=CHAR(27)
1686        BKT=CHAR(91)
1687        ESCBKT=ESC//BKT
1688        B=CHAR(66)
1689        IF (IROW.LT.10) WRITE (*,'(1X,A2,I1,A1,/)') ESCBKT,IROW,B
1690        IF (IROW.GE.10) WRITE (*,'(1X,A2,I2,A1,/)') ESCBKT,IROW,B
1691        END
```

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SUBROUTINE TOPLFT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1692
1693        SUBROUTINE TOPLFT
1694  C
1695  C  Move the cursor to the top left of the scrolling region.(ANSI)
1696  C
1697        CHARACTER*1 ESCAPE,L_BRACKET,SEMICOLON,H
1698        CHARACTER*2 ESCBKT
1699        INTRINSIC CHAR
1700        ESCAPE=CHAR(27)
1701        L_BRACKET=CHAR(91)
1702        ESCBKT=ESCAPE//L_BRACKET
1703        SEMICOLON=CHAR(59)
1704        H=CHAR(72)
1705        N=1
1706        WRITE (*,'(1X,A2,I1,A1,I1,A1,/)') ESCBKT,N,SEMICOLON,N,H
1707        END
```

NPREP Program listing

```
F77L - Lahey FORTRAN 77, Version 5.00    19 Mar 92 14:56:42                    Page    1
PROGRAM DIGITIZE_GIANT_IMAGE_DATA_FILE     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

      1       PROGRAM Digitize_Giant_Image_Data_File
      2  cccc
      3  c  c    Altek digitizer 4-button key control meanings:
      4  c  c                    #2:RED = error-backup
      5  c  c    #4:BLUE=abort photo         #1:YELLOW=missing
      6  c  c                    #3:GREEN=fiducial or data point
      7  cccc
      8       common /titlep/ title, page, out, img, dig
      9       character*74 title, irun*6, fn*12, day*8
     10       integer page, out, img, dig
     11       call SYSTEM ('cls')
     12       page=0
     13       out=1
     14       img=2
     15       dig=3
     16       write (*,*) 'Enter COMM Port number: '
     17       read (*,*) icmm
     18       icmm=icmm+48
     19       call SYSTEM ('mode com'//char(icmm)//':9600,o,7,2')
     20       open (dig,file = 'com'//char(icmm), access='transparent')
     21       call DATE (day)
     22  c
     23       write(*,*)
     24       write(*,*)'Enter 0 for initial conditions'
     25       write(*,*)'Enter 1 for head anthropometry'
     26       write(*,*)'Enter 2 for body anthropometry'
     27       write(*,*)
     28       read (*,*)ians
     29       if(ians==0)then
     30  1       write (*,*)
     31          write (*,*)'Enter RUN number (A6):  '
     32          read  (*,*) irun
     33          write(*,*)
     34          do i=1,6
     35             if(irun(i:i)==' ')go to 1
     36          enddo
     37          open (out,file =irun//'pr.out', status='new')
     38          open (img,file =irun//'im.dat', status='new')
     39          write (title,"(' Initial Conditions for Run # ',a6,24x,'    Date:'
     40       .                  ,a8)") irun, day
     41          call HEADS(ians)
     42       else
     43          write (*,*) 'Enter HRV number: '
     44          read  (*,*) ihrv
     45          write (*,*)
     46          if(ians==1)then
     47             write (*,*) 'Default ear offsets are: 5.420", 5.420".  ok?'
     48             write (*,*) 'Hit RETURN to accept. Any other key to change'
     49             write (*,*)
     50             i=ixkey()
     51             if (i/=13) then
```

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PROGRAM DIGITIZE_GIANT_IMAGE_DATA_FILE Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      52                write (*,*) 'Enter left & right ear offsets: '
      53                read  (*,*) ol, or
      54                write (*,*)
      55             else
      56                ol=5.420
      57                or=5.420
      58             endif
      59             write (fn, '(i4.4,''head.out'')')ihrv
      60             open (out,file =fn, status='new')
      61             write (fn, '(i4.4,''himg.dat'')')ihrv
      62             open (img,file =fn, status='new')
      63             write (img, *)ol, or
      64             write (title,"(' Head Anthropometry for HRV #  ',i5.5,
      65     .                      23x,'     Date: ', a8)") ihrv, day
      66             call HEADS(ians)
      67          elseif(ians==2)then
      68             write (fn, '(i4.4,''body.out'')')ihrv
      69             open (out,file =fn, status='new')
      70             write (fn, '(i4.4,''bimg.dat'')')ihrv
      71             open (img,file =fn, status='new')
      72             write (title,"(' Body Anthropometry for HRV #  ',i5.5,
      73     .                      23x,'     Date: ', a8)") ihrv, day
      74             call BODY
      75          endif
      76       endif
      77       write (*,*)
      78       end
```

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SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      79
      80       SUBROUTINE HEADS(ians)
      81 c       ians=0       Digitize Initial Conditions For Accelerator Run
      82 c       ians=1       Digitization Of Head Anthropometry
      83 c
      84 c     Revised January 25, 1992 by D. Francis
      85 c
      86       implicit real*8 (a-h,o-z)
      87       common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
      88       common /titlep/ title, page, out, img, dig
      89       character*74 title
      90       integer     page, out, img, dig, icm(6)
      91       character   data*17
      92       character*8 iframe(14), ilab(12), icont(35), itarg(40)
      93       integer     ibutt, ifid, ix, iy
      94       real*8      xy(2,33), calfid(2,4,8), foc(8), fk(4,8), xo(2,8)
      95       data ilab  /'   top 1','   top 2','   top 3','   rt  1',
      96      .            '   rt  2','   rt  3','   bot 1','   bot 2',
      97      .            '   bot 3','   lft 1','   lft 2','   lft 3'/
      98       data icont /'       a','       b','       c','       d',
      99      .            '       e','       f','       g','       h',
     100      .            '       i','       j','       k',
     101      .            '    rtc1','    rtc2','    rtc3','    rtc4',
     102      .            '    rtc5','    rtc6','    rtc7','    rtc8',
     103      .            '    cen1','    cen2','    cen3','    cen4',
     104      .            '    cen5','    cen6','    cen7','    cen8',
```

```
      105       .            '    lfc1',    lfc2',    lfc3',    lfc4',
      106       .            '    lfc5',    lfc6',    lfc7',    lfc8'/
      107       data itarg /'    m_r1',    m_r4',    m_t1',    m_t4',
      108       . '    m_b1',    m_b4',    m_l1',    m_l4',    t_r1',
      109       . '    t_r4',    t_c1',    t_c4',    t_l1',    t_l4',
      110       . ' mtar01',  mtar03',  mtar06',  mtar07',  mtar08',
      111       . ' mtar09',  mtar11',  htar02',  htar03',  htar04',
      112       . ' htar11',  htar13',  htar14',
      113       .
      114       . '     rtp',     ctp',     ltp',     ron',     lon',
      115       .            ' ear1-r',  ear2-r',  ear3-r',  ear4-r',
      116       .            ' ear1-l',  ear2-l',  ear3-l',  ear4-l'/
      117       data iframe /'     #1',      #2',      #3',
      118       .            '     #4',      #5',      #6',
      119       .            ' #1-580',  #2-736',  #3-674',  #4-623',
      120       .            ' #5-591',  #6-806',  #7-074',  #8-799'/
      121       data foc   / -55.003d0, -55.003d0, -55.005d0, -55.004d0,
      122       .            -55.002d0, -55.005d0, -55.001d0, -55.004d0/
      123       data calfid/18.1126,-12.1263, 18.1047, 12.1259,-18.1199, 12.1311,
      124       .          -18.1053,-12.1263, 18.1162,-12.1319, 18.1186, 12.1364,
      125       .          -18.1264, 12.1387,-18.1118,-12.1319,
      126       .           18.1101, 12.1239,-18.1170, 12.1277,-18.1071,-12.1219,
      127       .           18.1023,-12.1271, 18.1098, 12.1178,-18.1089, 12.1315,
      128       .          -18.1237,-12.1271, 18.1302,-12.1250, 18.1230, 12.1361,
      129       .          -18.1178, 12.1167,-18.1064,-12.1250, 18.1055,-12.1224,
      130       .           18.1109, 12.1266,-18.1340, 12.1414,-18.1046,-12.1224,
      131       .           18.1208,-12.1289, 18.1323, 12.1450,-18.1405, 12.1421,
```

```
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SUBROUTINE HEADS     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing
      132       .          -18.1083,-12.1289, 18.0867,-12.1120, 18.1023, 12.1168,
      133       .          -18.0823, 12.1091,-18.0953,-12.1120/
      134   c  Radial Lens Distortion Coefficients FK0, FK1, FK2, FK3
      135       data fk  /1.924312d-04,-2.839673d-06, 1.940416d-08,-4.715753d-11,
      136       .         6.467923d-04,-1.301398d-05, 7.699424d-08,-1.413951d-10,
      137       .         5.920576d-04,-1.120280d-05, 6.877133d-08,-1.358581d-10,
      138       .         7.242229d-04,-1.395773d-05, 8.152970d-08,-1.488803d-10,
      139       .         3.126069d-04,-7.650029d-06, 5.678321d-08,-1.212948d-10,
      140       .         7.208347d-04,-1.328443d-05, 7.942249d-08,-1.541224d-10,
      141       .         2.566426d-05,-8.466813d-07, 1.618407d-08,-5.114144d-11,
      142       .         6.696901d-04,-1.176637d-05, 6.149184d-08,-1.050377d-10/
      143   c  Offsets
      144       data xo  / -0.005, -0.022,  0.027,  0.088,  0.037,  0.088,
      145       .          -0.056,  0.132,  0.013,  0.122,  0.045,  0.036,
      146       .          -0.005, -0.022,  0.019,  0.140/
      147   c  Cameras assigned to each photo number
      148       data icm /1, 2, 3, 4, 5, 6/
      149       ncont=35
      150   c  27 for initial conditions (ians=0) & 13 for head anthro (ians=1)
      151       jt=27*ians
      152       ntarg=27
      153       if(ians==1) ntarg = 13
      154       units=.001d0
      155       sdx = .055d0
      156       sdy = .055d0
      157   c
      158    1  write (*,*) ' Enter Photo # (1-6, 0 when finished)  '
      159       read  (*,*) ipho
      160       call CLEAR
      161       if(ipho==0) go to 999
      162   c
      163       icam=icm(ipho)
      164       focal= foc(icam)
```

```
      call NEWPAG
      write (out,2) ifram(ipho)
 2    format (16x,'Calibrated Fiducial Coordinates of Frame ',a8//
     .                              26x, 'Fid', 9x, 'X', 12x, 'Y')
c
c  Write Calibrated Fiducial Coordinates
c
      do ifid=1, 4
         write (out,4) ifid,calfid(1,ifid,icam),calfid(2,ifid,icam)
 4       format (25x,i4,5x,f8.3,5x,f8.3)
      enddo
      write (out,8) focal, xo(1,icam),xo(2,icam)
 8    format (//sp,' Calibrated Focal Length = ',f9.3,' mm.  Xoff= ',
     .        f7.3,' mm.  Yoff= ',f7.3,' mm.')
      write (out,10) (fk(i,icam), i=1,4)
 10   format (////31x,sp,'Lens Distortion'//31x,'Radial Parameters'/11x
     . 'K0='d15.8d2,'  K1='d15.8d2,'  K2='d15.8d2/31x'K3='d15.8d2//)
c
c  Read & Write Frame ID
c
```


SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      write (img,12) ifram(ipho), focal, sdx, sdy,ifram(icam+6)
 12   format (a8,2x,sp,f10.3:,ss,2(f10.3),a8,2x)
      call NEWPAG
      write (out,14) ifram(ipho)
 14   format (20x,'Fiducial Measurements of Frame ',a8//  24x,'ID',12x,
     .  'Measured'/37x,'X',14x,'Y')

c  ***************************************************************************
c  Digitize edges:
      ifid=1
 20   write (*,*) 'Enter: ', ilab(ifid)
      read  (dig) data
      write (*,*) char(7)
c
c  DECODE data from CHARACTER to INTEGER
      if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
      read (data, 50) ibutt,ix,iy
 50   format (i1,1x,i6,1x,i6)
c
c  Interpret action to take based on which button was pressed:
      if (ibutt == 3) then           ! good
          xy(1,ifid)=ix*units
          xy(2,ifid)=iy*units
          ifid=ifid+1
      elseif (ibutt == 2) then       ! error - backup
          ifid=ifid-1
          write (*,*) 'Backing up one to  ',ilab(ifid)
          write (*,*) char(7),char(7)
      else
          write (*,*) 'Not an option. Redo'
      endif
      if (ifid <= 12) go to 20
c
c  Find the fiducials from these edges
      call FID(XY)                    ! 12 in & 4 out
      nfid=4
c
c   Store observed (digitized) coordinates
      do ifid=1,4
```

```
      224           do i=1,2
      225              obscor(i,ifid)=xy(i,ifid)
      226              calcor(i,ifid)=calfid(i,ifid,icam)
      227           enddo
      228           write (out,64) ifid,xy(1,ifid),xy(2,ifid)
      229    64     format (22x,i4,2f15.3)
      230         enddo
      231   c
      232   c  Compute the 4-Parameter Check Transformation.
      233   c
      234         ich3=0
      235         call FOURP
      236         write (*,*)' 4-Parameter Check Transformation'


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SUBROUTINE HEADS     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing
      237         rmsx=0.
      238         rmsy=0.
      239         do i=1,4
      240            x=obscor(1,i)
      241            y=obscor(2,i)
      242            dn=(x*del(4)+y*del(5)+1.0)
      243            xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
      244            yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
      245            write ( *,64) i,xt,yt
      246            rmsx=rmsx+xt*xt
      247            rmsy=rmsy+yt*yt
      248         enddo
      249         rmsx3=dsqrt(rmsx/nfid)
      250         rmsy3=dsqrt(rmsy/nfid)
      251         write (*,'('' rms= '',2f7.3/)')rmsx3, rmsy3
      252         write (*,*)'8-Parameter Transformation'
      253         rmsx=0.
      254         rmsy=0.
      255   c
      256   c  Compute the Multi-Parameter Transformation.
      257         call EIGHTP
      258         write (out,66)
      259    66   format (//17x,'8-Parameter Residuals of the Fiducial Coordinates'/
      260        .                      / 23x, 'Fid', 11x, 'X', 14x, 'Y')
      261   c
      262   c  Compute Residuals For the Fiducial Coordinates
      263   c
      264         do i=1,4
      265            x=obscor(1,i)
      266            y=obscor(2,i)
      267            dn=(x*del(4)+y*del(5)+1.0)
      268            xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
      269            yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
      270            write (out,64) i,xt,yt
      271            write (  *,64) i,xt,yt
      272            rmsx=rmsx+xt*xt
      273            rmsy=rmsy+yt*yt
      274         enddo
      275         rmsx=dsqrt(rmsx/4)
      276         rmsy=dsqrt(rmsy/4)
      277         write (*,'('' rms= '',2f7.3/)')rmsx, rmsy
      278         write (out, 68)rmsx, rmsy, rmsx3, rmsy3, del
      279    68   format(/23x,'Rms',2f15.3/23x,'Rms(check)',f8.3, f15.3/
      280        .       /25x,'Transformation Parameters Are:'/13x,2f11.6,f11.4,
      281        .                              2f11.6/13x,2f11.6,f11.4)
      282         call NEWPAG
      283         write (out,70)ipho
```

```
 284   70   format (//24x,'Plate Coordinates for Frame ',i4//18x,'ID',11x,
 285       .        'Measured',13x,'Adjusted'/30x,'X',9x,'Y',10x,'X',9x,'Y')
 286        write (out,*)'      Control:'
 287        pause
 288  c
 289  c*********************************************************************
```

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SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
 290  c  Digitize the control points for this photo
 291        icon=1
 292   100  write(*,*) 'Enter: ', icont(icon)
 293        read  (dig) data
 294        write (*,*) char(7)
 295  c
 296  c  DECODE data from CHARACTER to INTEGER
 297        if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
 298        read (data, 50) ibutt,ix,iy
 299  c
 300  c  Interpret action to take based on which button was pressed:
 301        if (ibutt == 4) then
 302            write (*,*) 'Abort requested. Restart photo.'
 303            write (*,*) char(7),char(7)
 304            write (out,*) 'Abort requested*******************************'
 305            write (img,*) 'Abort requested*******************************'
 306            go to 1
 307        elseif (ibutt == 3) then
 308            xy(1,icon)=ix*units
 309            xy(2,icon)=iy*units
 310            icon=icon+1
 311        elseif (ibutt == 2) then
 312            icon=icon-1
 313            write (*,*) 'Backing up one to  ',icont(icon)
 314            write (*,*) char(7),char(7)
 315        elseif (ibutt == 1) then
 316            xy(1,icon)=-1.
 317            xy(2,icon)=-1.
 318            write (*,*) '     missing ', icont(icon)
 319            write (*,*)
 320            icon=icon+1
 321        else
 322            write (*,*) 'Not an option. Redo'
 323        endif
 324        if (icon <= ncont) go to 100
 325  c
 326        icon=0
 327        do k=1,ncont        ! process control points
 328           icon=icon+1
 329    110     if (icon>ncont) go to 150
 330           if (xy(1,icon)<=0) then
 331              icon=icon+1
 332              go to 110
 333           endif
 334           x=xy(1,icon)
 335           y=xy(2,icon)
 336  c  Correct Measured Coordinates for Film Shrinkage & Offset
 337           dn=(x*del(4)+y*del(5)+1.0)
 338           xt=(x*del(1)+y*del(2)+del(3))/dn-xo(1,icam)
 339           yt=(x*del(6)+y*del(7)+del(8))/dn-xo(2,icam)
 340  c  Correct for Radial Lens Distortion:
 341           rt2=(xt**2+yt**2)
```

```
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SUBROUTINE HEADS     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing
     342           rt4=rt2*rt2
     343           rt6=rt4*rt2
     344           c1=fk(2,icam)*rt2+fk(3,icam)*rt4+fk(4,icam)*rt6+1.d0+fk(1,icam)
     345           xt=c1*xt
     346           yt=c1*yt
     347  c
     348           write (out,112) icont(icon),x,y,xt,yt
     349   112     format (14x,a8,2x,2f10.3,1x,2f10.3)
     350           write (img,114) icont(icon),xt,yt,iframe(ipho)
     351   114     format (a8,2x,2f10.4,15x,'Photo ',a8)
     352         enddo
     353  c
     354   150  write (out,*)'      Targets:'
     355         pause
     356
     357  c*************************************************************************
     358  c  Digitize the target points for this photo
     359         itar=1
     360   200  write(*,*) 'Enter: ', itarg(itar+jt)
     361         read  (dig) data
     362         write (*,*) char(7)
     363  c
     364  c  DECODE data from CHARACTER to INTEGER
     365         if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
     366         read (data, 50) ibutt,ix,iy
     367  c
     368  c  Interpret action to take based on which button was pressed:
     369         if (ibutt == 4) then
     370             write (*,*) 'Abort requested. Restart photo.'
     371             write (*,*) char(7),char(7)
     372             write (out,*) 'Abort requested*******************************'
     373             write (img,*) 'Abort requested*******************************'
     374             go to 1
     375         elseif (ibutt == 3) then
     376             xy(1,itar)=ix*units
     377             xy(2,itar)=iy*units
     378             itar=itar+1
     379         elseif (ibutt == 2) then
     380             itar=itar-1
     381             write (*,*) 'Backing up one to  ',itarg(itar+jt)
     382             write (*,*) char(7),char(7)
     383         elseif (ibutt == 1) then
     384             xy(1,itar)=-1.
     385             xy(2,itar)=-1.
     386             write (*,*) '     missing ', itarg(itar+jt)
     387             write (*,*)
     388             itar=itar+1
     389         else
     390             write (*,*) 'Not an option. Redo'
     391         endif
     392         if (itar <= ntarg) go to 200
     393  c
     394         itar=0
```

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SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      395         do k=1,ntarg        ! process target points
      396            itar=itar+1
      397    210     if (itar>ntarg) go to 250
      398            if (xy(1,itar)<=0) then
      399               itar=itar+1
      400               go to 210
      401            endif
      402            x=xy(1,itar)
      403            y=xy(2,itar)
      404    c  Correct Measured Coordinates for Film Shrinkage & Offset
      405            dn=(x*del(4)+y*del(5)+1.0)
      406            xt=(x*del(1)+y*del(2)+del(3))/dn-xo(1,icam)
      407            yt=(x*del(6)+y*del(7)+del(8))/dn-xo(2,icam)
      408    c  Correct for Radial Lens Distortion:
      409            rt2=(xt**2+yt**2)
      410            rt4=rt2*rt2
      411            rt6=rt4*rt2
      412            c1=fk(2,icam)*rt2+fk(3,icam)*rt4+fk(4,icam)*rt6+1.d0+fk(1,icam)
      413            xt=c1*xt
      414            yt=c1*yt
      415    c
      416            write (out,112) itarg(itar+jt),x,y,xt,yt
      417            write (img,114) itarg(itar+jt),xt,yt,ifram(ipho)
      418         enddo
      419    c
      420     250  write (img,'(A8)') '********'
      421    c
      422         go to 1
      423    c
      424     999  write (out,*)char(12)
      425         END
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      426  c-------------------------------------------------------------------------
      427         SUBROUTINE BODY
      428  c                    XRay Digitization Of Body Anthropometry
      429         implicit real*8 (a-h,o-z)
      430         common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
      431         common /titlep/ title, page, out, img, dig
      432         character*74 title
      433         integer page, out, img, dig
      434         character   data*17
      435         character*8 ifram(4),idbod(16), idpt
      436         integer     ibutt, ifid, ix, iy, idfd(10)
      437         real*8      xy(2,21), calfid(2,10,2)
      438         logical     iflag
      439         data ifram /'LfEyLfSh','RtEyLfSh', 'LfEyRtSh','RtEyRtSh'/
      440         data idbod /'Origin','Rib_Lf','Rib_Rt','SpineTop','SpineBot',
      441        .            'spine_bb','sternum',      'lf_shold','rt_shold',
      442        .            'ltp','rtp','ctp','lneckT','lneckB','rneckT','rneckB'/
      443         data calfid/-190.190,-147.150, -77.030,-160.380,  77.220,-158.830,
      444        .            192.510,-146.442,-190.060,   5.760, 191.570,   5.990,
      445        .           -190.490, 157.980, -75.380, 146.070,  77.730, 147.920,
      446        .            191.520, 158.540,-193.950,-148.160, -80.380,-162.380,
      447        .             75.670,-164.310, 191.214,-148.961,-193.920,   5.010,
      448        .            192.310,   4.800,-193.010, 159.210, -80.050, 147.600,
```

```
      .             75.390, 144.880, 192.720, 158.520/
c
c  Read order of transformation
      write (*,*) ' Enter number of parameters for shrinkage fit: '
      read  (*,*) iopt1
      write (*,*)
      if (iopt1>6)iopt1=8
      ich3s=0
      if (iopt1<=3) then
           ich3s=1
           iopt1=3
      end if
      nbod=16
      units=.0254d0
      sdx = 1.0d0
      sdy = 1.0d0
c
 1    write (*,*) ' Enter 0 when finished'
      write (*,*) ' Enter 1 if:  Left Eye View---Left Shoulder to Plate'
      write (*,*) ' Enter 2 if: Right Eye View---Left Shoulder to Plate'
      write (*,*) ' Enter 3 if:  Left Eye View--Right Shoulder to Plate'
      write (*,*) ' Enter 4 if: Right Eye View--Right Shoulder to Plate'
      write (*,*)
      read (*,*) ians
      if(ians==0) go to 999
c
      call CLEAR
c
      focal= -889.0d0
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      call NEWPAG
      write (out,2400)iframe(ians)
c
c  Write Calibrated Fiducial Coordinates
c
      jfid=2
      do ifid=1, 10
         write (out,2420) ifid,calfid(1,ifid,jfid),calfid(2,ifid,jfid)
      enddo
c
c  Read & Write Frame ID
c
      write (img,1516) iframe(ians), focal, sdx, sdy
      call NEWPAG
      write (out,2380) iframe(ians)
c*****************************************************************************
c  Start major loop for digitizing x-rays:
      iflag=.true.
      IFID=1
 10   read (dig) DATA
      write (*,*) CHAR(7)
c
c  DECODE data from CHARACTER to INTEGER
c
      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
      read (DATA, 20) IBUTT,IX,IY
 20   FORMAT (I1,1X,I6,1X,I6)
c
c  Interpret action to take based on which button was pressed:
      if (ibutt == 3) then
```

```
508             xy(1,ifid)=ix*units
509             xy(2,ifid)=iy*units
510             write (*,30) ' FIDUCIAL',ifid,xy(1,ifid),xy(2,ifid)
511   30        format (a,1x,i3,2x,f8.4,2x,f8.4)
512             if(iflag)then
513                 isavex=ix
514                 isavey=iy
515                 iflag=.false.
516              endif
517             ifid=ifid+1
518         elseif (ibutt == 2) then
519             ifid=ifid-1
520             write (*,*) 'Backing up one to FIDUCIAL # ',ifid
521             write (*,*) char(7),char(7)
522         elseif (ibutt == 1) then
523             xy(1,ifid)=-1.
524             xy(2,ifid)=-1.
525             write (*,*) '      MISSING ', ifid
526             ifid=ifid+1
527         else
528             write (*,*) 'Not an option. Redo'
529         endif
```



```
530         if (ifid <= 10) go to 10
531   c
532         ifid=0
533         do k=1,10
534   c
535   c   Store observed (digitized) coordinates
536   c
537             ifid=ifid+1
538    80       if (ifid>10) go to 210
539             if (xy(1,ifid)<=0) then
540                ifid=ifid+1
541                go to 80
542             endif
543             kk=ifid
544             do i=1,2
545                obscor(i,ifid)=xy(i,ifid)
546                calcor(i,ifid)=calfid(i,kk,jfid)
547             enddo
548             idfd(k)=kk
549             write (out,64) kk,xy(1,ifid),xy(2,ifid)
550    64       format (22x,i4,2f15.3)
551         enddo
552   c
553   c  Compute the 3-Parameter Check Transformation.
554   c
555    210  nfid=k-1
556         ich3=1
557         call FOURP
558         write (*,*)' 3-Parameter Check Transformation'
559         rmsx=0.
560         rmsy=0.
561         do i=1,nfid
562            x=obscor(1,i)
563            y=obscor(2,i)
564            den=(x*del(4)+y*del(5)+1.0)
565            xt=(x*del(1)+y*del(2)+del(3))/den-calcor(1,i)
```

```
566           yt=(x*del(6)+y*del(7)+del(8))/den-calcor(2,i)
567           kk=idfd(i)
568           write ( *,2560) kk,xt,yt
569           rmsx=rmsx+xt*xt
570           rmsy=rmsy+yt*yt
571         enddo
572         rmsx3=dsqrt(rmsx/nfid)
573         rmsy3=dsqrt(rmsy/nfid)
574         write (*,230)rmsx, rmsy
575    230  format (' rms= ',2f7.3)
576         write (*,*)
577         write (*,*)iopt1,'-Parameter Transformation'
578         rmsx=0.
579         rmsy=0.
580   c
581   c  Compute the Multi-Parameter Transformation.
582         ich3=ich3s

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SUBROUTINE BODY    Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

583         if (iopt1<=5) call FOURP
584         if (iopt1==5) call FIVEP
585         if (iopt1==6) call SIXP
586         if (iopt1==8) call EIGHTP
587         write (out,2550) iopt1
588   c
589   c  Compute Residuals For the Fiducial Coordinates
590   c
591         do i=1,nfid
592           x=obscor(1,i)
593           y=obscor(2,i)
594           dn=(x*del(4)+y*del(5)+1.0)
595           xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
596           yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
597           kk=idfd(i)
598           write (out,2560) kk,xt,yt
599           write ( *,2560) kk,xt,yt
600           rmsx=rmsx+xt*xt
601           rmsy=rmsy+yt*yt
602         enddo
603         rmsx=dsqrt(rmsx/nfid)
604         rmsy=dsqrt(rmsy/nfid)
605         write (*,230)rmsx, rmsy
606         write(out, 2545)rmsx, rmsy, rmsx3, rmsy3, del
607    2545 format(/23x,'Rms',2f15.3/23x,'Rms(check)',f8.3, f15.3/
608        .       /25x,'Transformation Parameters Are:'/13x,2f11.6,f11.4,
609        .                              2f11.6/13x,2f11.6,f11.4)
610         call NEWPAG
611         write (out,2575)iframe(ians)
612         pause
613   c*************************************************************************
614    500  ibod=1
615    550  read (dig) data
616         write (*,*) CHAR(7)
617   c
618   c  DECODE data from CHARACTER to INTEGER
619   c
620         if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
621         read (data, 20) ibutt,ix,iy
622   c
623   c  Interpret action to take based on which button was pressed:
```

```
      624         if (ibutt == 4) then
      625             write (*,*) 'Abort requested. Restart photo.'
      626             write (*,*) char(7),char(7)
      627             write (out,*) 'Abort requested*******************************'
      628             write (img,*) 'Abort requested*******************************'
      629             go to 1
      630         elseif (ibutt == 3) then
      631             xy(1,ibod)=IX*units
      632             xy(2,ibod)=IY*units
      633             write (*,555)idbod(ibod),xy(1,ibod),xy(2,ibod)
      634    555      format (a10,2x,f8.4,2x,f8.4)
```



```
      635             ibod=ibod+1
      636         elseif (ibutt == 2) then
      637             ibod=ibod-1
      638             write (*,*) 'Backing up one to ', idbod(ibod)
      639             wRITE (*,*) char(7),char(7)
      640         elseif (ibutt == 1) then
      641             xy(1,ibod)=-1.
      642             xy(2,ibod)=-1.
      643             write (*,*) 'MISSING ', idbod(ibod)
      644             ibod=ibod+1
      645         else
      646             write (*,*) 'Not an option. Redo'
      647         endif
      648         if (ibod <= nbod) go to 550
      649   c
      650         ibod=0
      651         do 690 k=1,nbod
      652   c
      653   c  Process measured body coordinates
      654   c
      655              ibod=ibod+1
      656    590       if (ibod>nbod) go to 700
      657              if (xy(1,ibod)<=0) then
      658                 ibod=ibod+1
      659                 go to 590
      660              endif
      661              kk=ibod
      662              x=xy(1,ibod)
      663              y=xy(2,ibod)
      664              idpt=idbod(ibod)
      665   c
      666   c  Correct Measured Coordinates for Film Shrinkage
      667   c
      668              xt=(x*del(1)+y*del(2)+del(3))/(x*del(4)+y*del(5)+1.0)
      669              yt=(x*del(6)+y*del(7)+del(8))/(x*del(4)+y*del(5)+1.0)
      670   c
      671              write (out,2605) idpt,x,y,xt,yt
      672   c
      673   c  Write Records for Triangulation Input to file: "img.dat"
      674              write (img,1610) idpt,xt,yt,ifram(ians)
      675    690  continue
      676   c
      677    700  icount=0
      678    710  write (*,*)' Re-do first fiducial'
      679         read (dig) data
      680         write (*,*) char(7)
      681   c
      682   c  DECODE data from CHARACTER to INTEGER
```

```
683  c
684        if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
685        read (data, 20) ibutt,ix,iy
686        if(iabs(ix-isavex)+iabs(iy-isavey) > 3*(rmsx+rmsy)/units)then


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SUBROUTINE BODY     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

687           write (*,*)'  You blew it', ix, iy, ' vs.', isavex, isavey
688           write (*,*) char(7)
689           write (*,*) char(7)
690           icount=icount+1
691           if(icount<=4) go to 710
692           write(*, *)'No more tries...origin lost...going back to menu'
693           write (img,'(a8)') '********'
694           go to 1
695        endif
696        pause
697        write (img,'(a8)') '********'
698        go to 1
699  c
700   999  call CLEAR
701        write (out,*)char(12)
702  c
703   1370 format (2i1,8x,3f10.3)
704   1410 format (2x,i4,4x,2f10.4)
705   1440 format (2d20.10)
706   1445 format (3d20.10)
707   1450 format (//42x,sp,'CALIBRATED FOCAL LENGTH = ',f9.3,' mm.')
708   1460 format (////51x,sp,'LENS DISTORTION'//51x,'RADIAL PARAMETERS'/31x
709       .        'K0='d15.8d2,'  K1='d15.8d2,'  K2='d15.8d2/51x'K3='d15.8d2
710       .        ,//:45x,'LENS DECENTRATION PARAMETERS'/31x,'J1= 'd15.8d2,
711       .        '  J2= 'd15.8d2,' PHI= 'd15.8d2/)
712  c
713   1470 format (i2)
714   1480 format (2f10.3)
715   1485 format (8x,'Calibrated Focal Length (CFL) in millimeters = ')
716   1500 format (44x,2f13.3)
717   1510 format (6x,i4,6f10.3)
718   1516 format (a8,2x,sp,f10.3:,ss,2(f10.3),10x)
719   1580 format (2x,a8,6f10.3)
720   1605 format (34x,a8,2x,2f10.3,1x,2f10.3)
721   1610 format (a8,2x,2f10.4,15x,'Photo ',a8)
722  c
723   2380 format (20X,'Fiducial Measurements of Frame ',a8//  24x,'ID',12x,
724       .  'Measured'/37x,'X',14x,'Y')
725   2400 format (16x,'Calibrated Fiducial Coordinates of Frame ',a8//
726       .                          26x, 'Fid', 9x, 'X', 12x, 'Y')
727   2420 format (25x,i4,5x,f8.3,5x,f8.3)
728   2450 format (//25x,sp,'Calibrated Focal Length = ',f9.3,' mm.')
729   2460 format (////31x,sp,'Lens Distortion'//31x,'Radial Parameters'/11x
730       .        'K0='d15.8d2,'  K1='d15.8d2,'  K2='d15.8d2/31x'K3='d15.8d2
731       .        ,//:25x,'Lens Decentration Parameters'/11x,'J1= 'd15.8d2,
732       .        '  J2= 'd15.8d2,' PHI= 'd15.8d2/)
733   2500 format (24x,2f13.3)
734   2550 format (//i18,'-Parameter Residuals of the Fiducial Coordinates'//
735       .                          23x, 'Fid', 11x, 'X', 14x, 'Y')
736   2560 format (22x,i4,2f15.3)
737   2570 format (//22x,'Plate Coordinates for Frame ',a8//'     ID',11x,
738       .        'Measured',13x,'Adjusted',13x,'Max Spread',11x,'Frame'/
739       .        17x,'X',9x,'Y',10x,'X',9x,'Y',10x,'X',9x,'Y')
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
740   2575 format (//22x,'Plate Coordinates for Frame ',a8//18x,'ID',11x,
741      .        'Measured',13x,'Adjusted'/30x,'X',9x,'Y',10x,'X',9x,'Y')
742   2600 format (x,a8,2x,2f10.3,1x,2f10.3,1x,2f10.3)
743   2605 format (14x,a8,2x,2f10.3,1x,2f10.3)
744        end
```

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SUBROUTINE FID Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
745  c-------------------------------------------------------------------------
746        SUBROUTINE FID(Z)
747  c  Intersects the edge lines (formed by a least squares on 3 points)
748  c  to give the corner fiducials. Stores output back in the input array.
749        implicit real*8 (a-d, x-z)
750        real*8 z(2,12), x(3), y(3)
751        n=3
752  c  left
753        x1=0.
754        y1=0.
755        y2=0.
756        xy=0.
757        do i=1, 3
758           x(i)=z(1,9+i)      ! 10, 11, 12
759           y(i)=z(2,9+i)
760           x1=x1+x(i)
761           y1=y1+y(i)
762           y2=y2+y(i)*y(i)
763           xy=xy+x(i)*y(i)
764        enddo
765        den=n*y2-y1*y1
766        c= ( n*xy-y1*x1)/den
767        d=-(y1*xy-x1*y2)/den
768  c  top
769        x1=0.
770        y1=0.
771        x2=0.
772        xy=0.
773        do i=1, 3
774           x(i)=z(1,i)        ! 1, 2, 3
775           y(i)=z(2,i)
776           x1=x1+x(i)
777           y1=y1+y(i)
778           x2=x2+x(i)*x(i)
779           xy=xy+x(i)*y(i)
780        enddo
781        den=n*x2-x1*x1
782        a= ( n*xy-y1*x1)/den
783        b=-(x1*xy-y1*x2)/den
784  c
785        z(1,3)=(b*c+d)/(1-a*c)          ! upper left = 3rd
786        z(2,3)=(a*d+b)/(1-a*c)
787  c
788        cx=c
789        dx=d
790  c  right
791        x1=0.
```

```
      792         y1=0.
      793         y2=0.
      794         xy=0.
      795         do i=1, 3
      796            x(i)=z(1,3+i)      ! 4, 5, 6
```

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SUBROUTINE FID Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      797            y(i)=z(2,3+i)
      798            x1=x1+x(i)
      799            y1=y1+y(i)
      800            y2=y2+y(i)*y(i)
      801            xy=xy+x(i)*y(i)
      802         enddo
      803         den=n*y2-y1*y1
      804         c= ( n*xy-y1*x1)/den
      805         d=-(y1*xy-x1*y2)/den
      806   c
      807         z(1,2)=(b*c+d)/(1-a*c)           ! upper right = 2nd
      808         z(2,2)=(a*d+b)/(1-a*c)
      809   c  bottom
      810         x1=0.
      811         y1=0.
      812         x2=0.
      813         xy=0.
      814         do i=1, 3
      815            x(i)=z(1,6+i)      ! 7, 8, 9
      816            y(i)=z(2,6+i)
      817            x1=x1+x(i)
      818            y1=y1+y(i)
      819            x2=x2+x(i)*x(i)
      820            xy=xy+x(i)*y(i)
      821         enddo
      822         den=n*x2-x1*x1
      823         a= ( n*xy-y1*x1)/den
      824         b=-(x1*xy-y1*x2)/den
      825   c
      826         z(1,1)=(b*c+d)/(1-a*c)           ! lower right = 1st
      827         z(2,1)=(a*d+b)/(1-a*c)
      828   c
      829         z(1,4)=(b*cx+dx)/(1-a*cx)        ! lower left  = 4th
      830         z(2,4)=(a*dx+b )/(1-a*cx)
      831         end
```

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SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      832   c-------------------------------------------------------------------------
      833         SUBROUTINE FOURP
      834   c
      835   c  Calculate the 3 or 4 Parameter Transformation Between an Exact Set
      836   c       of Data and a Corresponding Set of Measured Data.
      837   c
      838         implicit real*8 (a-h,o-z)
      839         intrinsic dsqrt
      840         dimension am(2,4), cm(2)
      841         common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
```

```
      c
            do i=1,4
               do j=1,5
                 eqn(i,j)=0.0d0
               enddo
            enddo
            am(1,3)=1.0d0
            am(1,4)=0.0d0
            am(2,3)=0.0d0
            am(2,4)=1.0d0
            do i=1,nfid
                 am(1,1)=obscor(1,i)
                 am(1,2)=obscor(2,i)
                 am(2,1)=am(1,2)
                 am(2,2)=-am(1,1)
                 cm(1)=calcor(1,i)
                 cm(2)=calcor(2,i)
                 do j=1,4
                      do k=1,2
                           eqn(j,5)=eqn(j,5)+am(k,j)*cm(k)
                           do l=1,4
                                eqn(j,l)=eqn(j,l)+am(k,j)*am(k,l)
                           enddo
                      enddo
                 enddo
            enddo
            call LINSOL(4)
            if (ich3==0) go to 1060
      c
      c  If ich3<>0 Transform the 4-param to a 3-param
      c
            scale=eqn(1,5)**2+eqn(2,5)**2
            scale=dsqrt(scale)
            eqn(1,5)=eqn(1,5)/scale
            eqn(2,5)=eqn(2,5)/scale
            sum1=0.0d0
            sum2=0.0d0
            do i=1,nfid
                 x=obscor(1,i)
                 y=obscor(2,i)
                 sum1=sum1+calcor(1,i)-eqn(1,5)*x-eqn(2,5)*y
                 sum2=sum2+calcor(2,i)+eqn(2,5)*x-eqn(1,5)*y
```

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SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
            enddo
            eqn(3,5)=sum1/nfid
            eqn(4,5)=sum2/nfid
      c
      c  Form Transformation parameters vector
      c
       1060 del(1)=eqn(1,5)
            del(2)=eqn(2,5)
            del(3)=eqn(3,5)
            del(4)=0.0d0
            del(5)=0.0d0
            del(6)=-del(2)
            del(7)=del(1)
            del(8)=eqn(4,5)
            end
```

```
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SUBROUTINE FIVEP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

      899  c-------------------------------------------------------------------------
      900         SUBROUTINE FIVEP
      901  c
      902  c  Calculate the FIVE Parameter Transformation Between an Exact Set
      903  c       of Data and a Corresponding Set of Measured Data.
      904  c
      905         implicit real*8 (a-h,o-z)
      906         intrinsic dsin, dcos, dabs
      907         dimension b(2,5),c(2),cv(5),par(5)
      908         common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
      909  c
      910         par(1)=dsqrt(del(1)**2+del(2)**2)
      911         par(2)=par(1)
      912         par(3)=datan2(del(2),del(1))
      913         par(4)=del(3)
      914         par(5)=del(8)
      915         b(1,2)=0.0d0
      916         b(1,5)=0.0d0
      917         b(2,1)=0.0d0
      918         b(2,4)=0.0d0
      919         do 30 ii=1,10
      920            do i=1, 5
      921               cv(i)=0.0d0
      922               do j=1, 5
      923                  eqn(i, j)=0.0d0
      924               enddo
      925            enddo
      926            do i=1,nfid
      927               b(1,4)=par(1)
      928               b(2,5)=par(2)
      929               sint=dsin(par(3))
      930               cost=dcos(par(3))
      931               x=obscor(1,i)
      932               y=obscor(2,i)
      933               c1=-x*sint+y*cost
      934               c2= x*cost+y*sint
      935               b(1,1)=c2*par(1)
      936               b(1,3)=c1*par(1)**2
      937               b(2,2)=c1*par(2)
      938               b(2,3)=-c2*par(2)**2
      939               c(1)=par(1)*(calcor(1,i)-par(1)*c2-par(4))
      940               c(2)=par(2)*(calcor(2,i)-par(2)*c1-par(5))
      941               do j=1,5
      942                  do k=1,2
      943                     cv(j)=cv(j)+b(k,j)*c(k)
      944                     do l=1,5
      945                        eqn(j,l)=eqn(j,l)+b(k,j)*b(k,l)
      946                     enddo
      947                  enddo
      948               enddo
      949            enddo
      950  c
      951  c   Solve normal equations
```

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SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      c
               call LINSOL(5)
               do j=1, 5
                  par(j)=par(j)+eqn(j, 6)
               enddo
      c
      c   Test for convergence
      c
               do 20 j=1, 5
                  c1=dabs(eqn(j, 6))
                  epsln=1.0d-6
                  if(j>3)epsln=1.0d-4
                  if(c1>epsln)go to 30
      20       continue
               go to 40
      30    continue
            call CLEAR
            write (*,*) char(7)
            write (*,*)' Error in FIVEP'
            stop
      c
      c   Form transformation parameters vector
      c
      40    sint=dsin(par(3))
            cost=dcos(par(3))
            del(1)=par(1)*cost
            del(2)=par(1)*sint
            del(3)=par(4)
            del(4)=0.0d0
            del(5)=0.0d0
            del(6)=-par(2)*sint
            del(7)=par(2)*cost
            del(8)=par(5)
            end
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
      c-------------------------------------------------------------------------
            SUBROUTINE SIXP
      c
      c  Calculate the SIX Parameter Transformation Between an Exact Set
      c       of Data and a Corresponding Set of Measured Data.
      c
            implicit real*8 (a-h,o-z)
            dimension ans(2,3), ccc(3,3), ddd(3,2), rrr(2,2), err(2)
            common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
      c
      c  Zero Normal Equation Area.
      c
            do i=1,2
               do j=1,3
                  ccc(i,j)=0.0d0
                  ddd(j,i)=0.0d0
               enddo
            enddo
```

```
1004  c
1005  c  Compute Normal Equations
1006  c
1007        do i=1,nfid
1008           do j=1,2
1009              ccc(j,3)=ccc(j,3)+calcor(j,i)
1010              ddd(3,j)=ddd(3,j)+obscor(j,i)
1011              do k=1,2
1012                 ccc(j,k)=ccc(j,k)+calcor(j,i)*calcor(k,i)
1013                 ddd(j,k)=ddd(j,k)+calcor(j,i)*obscor(k,i)
1014              enddo
1015           enddo
1016        enddo
1017        ccc(3,1)=ccc(1,3)
1018        ccc(3,2)=ccc(2,3)
1019        ccc(3,3)=nfid
1020  c
1021  c  Compute Inverse of Normal Matrix.
1022  c
1023        iggy=3
1024        call INVERT (CCC,IGGY,DET)
1025  c
1026  c  Compute the Transformation Parameters
1027  c
1028        do i=1,2
1029           do j=1,3
1030              ans(i,j)=0.0d0
1031              do k=1,3
1032                 ans(i,j)=ans(i,j)+ccc(j,k)*ddd(k,i)
1033              enddo
1034           enddo
1035        enddo
1036  c
1037  c  Calculate the Transformation from Measured Data to Exact Data.
1038  c
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1039        do i=1,2
1040           do j=1,2
1041              rrr(i,j)=ans(i,j)
1042           enddo
1043        enddo
1044        iggy=2
1045        call INVERT (RRR,IGGY,DET)
1046        do i=1,2
1047           do j=1,2
1048              ans(i,j)=rrr(i,j)
1049           enddo
1050        enddo
1051        do i=1,2
1052           err(i)=-ans(i,1)*ans(1,3)-ans(i,2)*ans(2,3)
1053        enddo
1054        do i=1,2
1055           ans(i,3)=err(i)
1056        enddo
1057  c
1058  c  Form transformation parameters vector
1059  c
1060        del(1)=ans(1,1)
1061        del(2)=ans(1,2)
```

```
      del(3)=ans(1,3)
      del(4)=0.0d0
      del(5)=0.0d0
      del(6)=ans(2,1)
      del(7)=ans(2,2)
      del(8)=ans(2,3)
      end
```

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SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
c-------------------------------------------------------------------------
      SUBROUTINE EIGHTP
c
c  Calculate the EIGHT Parameter Transformation Between an Exact Set
c       of Data and a Corresponding Set of Measured Data.
c
      implicit real*8 (a-h,o-z)
      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
      real*8    tem(8)
c
c  Zero the matrix of linear equations EQN
c
      do i=1,8
         del(i)=0.0d0
         do j=1,9
            eqn(i,j)=0.0d0
         enddo
      enddo
c
c  Compute approximate values for the transformation parameters
c
      do i=1,nfid
         call ACCAPR (calcor(1,i),calcor(2,i),obscor(1,i),obscor(2,i))
      enddo
      n=8
      call INVERT (eqn, n, d)
      do i=1, 8
         do j=1, 8
            del(i)=del(i)+eqn(i, j)*eqn(j, 9)
         enddo
      enddo
c
c  Compute the transformation parameters by least squares
c
      do 50 m=1,5
c
c  Zero the normal equations
c
         do i=1,8
            tem(i)=0.0d0
            do j=1,9
               eqn(i,j)=0.0d0
            enddo
         enddo
c
c  Form the normal equations
c
         do i=1,nfid
            call ACCNEQ(calcor(1,i),calcor(2,i),obscor(1,i),obscor(2,i))
         enddo
c
```

```
1120  c  Solve the normal equations
1121  c
```

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SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1122           call INVERT(eqn, n, d)
1123           do i=1, 8
1124              do j=1, 8
1125                 tem(i)=tem(i)+eqn(i, j)*eqn(j, 9)
1126              enddo
1127           enddo
1128  c
1129  c  Correct the approximate values of the transformation parameters
1130  c
1131           do i=1, 8
1132              del(i)=del(i)+tem(i)
1133           enddo
1134  c
1135  c  Test the solution for convergence
1136  c
1137           do i=1,8
1138              d=dabs(del(i)/(del(i)-tem(i))-1.0)
1139              if (d>.001d0) go to 50
1140           enddo
1141           return
1142   50   continue
1143        end
```

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SUBROUTINE LINSOL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1144  c-------------------------------------------------------------------------
1145        SUBROUTINE LINSOL(NPAR)
1146  c
1147  c  Solution of (NPAR) linear equations in (NPAR) unknowns.
1148  c
1149        implicit real*8 (a-h,o-z)
1150        common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1151  c
1152        do 1040 k=1,npar
1153             m=npar+1
1154             do j=k,npar+1
1155                  eqn(k,m)=eqn(k,m)/eqn(k,k)
1156                  m=m-1
1157             enddo
1158             do 1030 i=1,npar
1159                  if (i==k) go to 1030
1160                  m=npar+1
1161                  do l=k,npar+1
1162                       eqn(i,m)=eqn(i,m)-eqn(i,k)*eqn(k,m)
1163                       m=m-1
1164                  enddo
1165   1030      continue
1166   1040 continue
1167  c
1168        end
```

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SUBROUTINE ACCAPR Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1169  c-------------------------------------------------------------------------
1170        SUBROUTINE ACCAPR (XG,YG,XP,YP)
1171  c
1172  c  Evaluate the contribution of one point to the 8 by 9 matrix of
1173  c  normal equations for computation of approximate values of the
1174  c  eight-parameter film shrinkage transformation.
1175  c
1176  c          XG:  Calibrated X Fiducial coordinate
1177  c          YG:  Calibrated Y Fiducial coordinate
1178  c          XP:  Observed X Fiducial coordinate
1179  c          YP:  Observed Y Fiducial coordinate
1180  c         EQN:  8 X 8 Coefficient matrix of the Normal Equation
1181  c               with the vector of constants in column 9.
1182  c
1183        implicit real*8 (a-h,o-z)
1184        dimension am(2,8), bm(2)
1185        common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1186  c
1187        am(1,1)=xp
1188        am(1,2)=yp
1189        am(1,3)=1.0d0
1190        am(1,4)=-xg*xp
1191        am(1,5)=-xg*yp
1192        am(1,6)=0.0d0
1193        am(1,7)=0.0d0
1194        am(1,8)=0.0d0
1195        am(2,1)=0.0d0
1196        am(2,2)=0.0d0
1197        am(2,3)=0.0d0
1198        am(2,4)=-xp*yg
1199        am(2,5)=-yp*yg
1200        am(2,6)=xp
1201        am(2,7)=yp
1202        am(2,8)=1.0d0
1203        bm(1)=xg
1204        bm(2)=yg
1205        do i=1,8
1206           do j=1,8
1207              do k=1,2
1208                 eqn(i,j)=eqn(i,j)+am(k,i)*am(k,j)
1209              enddo
1210           enddo
1211        enddo
1212        do i=1,8
1213           do j=1,2
1214                eqn(i,9)=eqn(i,9)+am(j,i)*bm(j)
1215           enddo
1216        enddo
1217        end
```

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SUBROUTINE ACCNEQ Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1218  c-------------------------------------------------------------------------
1219        SUBROUTINE ACCNEQ (XG,YG,XP,YP)
1220  c
```

```
1221  c  Evaluate the contribution of one point to the normal equation
1222  c  required for Subroutine EIGHT.  The normal equations are
1223  c  required to compute corrections to the last estimate of the
1224  c  eight transformation parameters.  This is called once for each
1225  c  point.
1226  c
1227  c          XG:  Calibrated X Fiducial coordinate
1228  c          YG:  Calibrated Y Fiducial coordinate
1229  c          XP:    Observed X Fiducial coordinate
1230  c          YP:    Observed Y Fiducial coordinate
1231  c         EQN:  8 X 8 Coefficient matrix of the Normal Equation
1232  c               with the vector of constants in column 9.
1233  c
1234  c
1235        implicit real*8 (a-h,o-z)
1236        dimension am(2,2), bm(2,8), cm(2), amm(2,2)
1237        common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1238  c
1239        am(1,1)=del(1)-xg*del(4)
1240        am(1,2)=del(2)-xg*del(5)
1241        am(2,1)=del(6)-yg*del(4)
1242        am(2,2)=del(7)-yg*del(5)
1243        bm(1,1)=xp
1244        bm(1,2)=yp
1245        bm(1,3)=1.0d0
1246        bm(1,4)=-xp*xg
1247        bm(1,5)=-yp*xg
1248        bm(1,6)=0.0d0
1249        bm(1,7)=0.0d0
1250        bm(1,8)=0.0d0
1251        bm(2,1)=0.0d0
1252        bm(2,2)=0.0d0
1253        bm(2,3)=0.0d0
1254        bm(2,4)=-xp*yg
1255        bm(2,5)=-yp*yg
1256        bm(2,6)=xp
1257        bm(2,7)=yp
1258        bm(2,8)=1.0d0
1259        cm(1)=xp*am(1,1)+yp*am(1,2)+del(3)-xg
1260        cm(2)=xp*am(2,1)+yp*am(2,2)+del(8)-yg
1261  c
1262  c  Form modified covariance matrix AMM
1263  c
1264        do i=1,2
1265           do j=1,2
1266              amm(i,j)=0.0d0
1267              do k=1,2
1268                 amm(i,j)=amm(i,j)+am(i,k)*am(j,k)
1269              enddo
```

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SUBROUTINE ACCNEQ Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1270           enddo
1271        enddo
1272        d=amm(1,1)*amm(2,2)-amm(1,2)*amm(2,1)
1273        am(1,1)= amm(2,2)/d
1274        am(2,2)= amm(1,1)/d
1275        am(1,2)=-amm(2,1)/d
1276        am(2,1)= amm(1,2)
1277  c
1278  c  Form normal equations
```

```
1279  c
1280        do i=1,8
1281           do j=1,8
1282              do k=1,2
1283                 do l=1,2
1284                    eqn(i,j)=eqn(i,j)+bm(k,i)*am(k,l)*bm(l,j)
1285                 enddo
1286              enddo
1287           enddo
1288        enddo
1289        do i=1,8
1290           do k=1,2
1291              do l=1,2
1292                 eqn(i,9)=eqn(i,9)-bm(k,i)*am(k,l)*cm(l)
1293              enddo
1294           enddo
1295        enddo
1296        end
```

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SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1297  c-------------------------------------------------------------------------
1298        SUBROUTINE INVERT (A,N,D)
1299  c
1300  c  Find the Inverse of a Matrix by the Gaussian Elimination Method.
1301  c  A: Array in which the matrix to be inverted is located.
1302  c     The routine will search for the largest non-singular matrix in
1303  c     the array A and invert it & return it in the same locations of A.
1304  c  N: The first dimension of A. It must be a variable in the call list.
1305  c     The rank of largest matrix contained in A will be returned in N.
1306  c  D: The determinant of the largest non-singular matrix in A.
1307  c  L & M: Vectors of dimension N used temporarily.
1308  c
1309  c
1310        implicit real*8 (a-h,o-z)
1311        dimension a(64), l(8), m(8)
1312  c
1313  c  Initiate the continued product of pivots becoming the determinant.
1314  c
1315        d=1.0d0
1316  c
1317  c  Initiate the counter which contains the rank of the matrix.
1318  c
1319        ksave=0
1320  c
1321  c  Start the main elimination loop.
1322  c
1323        do 1090 k=1,n
1324  c
1325  c  Search for the largest element
1326  c
1327              l(k)=k
1328              m(k)=k
1329              kk=k+n*(k-1)
1330              biga=a(kk)
1331              do 1010 i=k,n
1332                   do 1010 j=k,n
1333                   ij=i+n*(j-1)
1334                   if (dabs(biga)>=dabs(a(ij))) go to 1010
1335                   biga=a(ij)
1336                   l(k)=i
```

```
1337                    m(k)=j
1338   1010       continue
1339   c
1340   c  Largest element of zero means the largest matrix in A is less than N.
1341   c
1342               if (biga==0) GO TO 1100
1343   c
1344   c  Interchange rows
1345   c
1346               j=l(k)
1347               ksave=k
1348               if (l(k)<=k) go to 1030
```

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SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1349               do i=1,n
1350                    ki=k+n*(i-1)
1351                    ji=j+n*(i-1)
1352                    tem=-a(ki)
1353                    a(ki)=a(ji)
1354                    a(ji)=tem
1355               enddo
1356   c
1357   c  Interchange columns.
1358   c
1359    1030       i=m(k)
1360               if (m(k)<=k) go to 1050
1361               do j=1,n
1362                    jk=j+n*(k-1)
1363                    ji=j+n*(i-1)
1364                    tem=-a(jk)
1365                    a(jk)=a(ji)
1366                    a(ji)=tem
1367               enddo
1368   c
1369   c  Divide column by minus pivot
1370   c
1371    1050       do 1060 i=1,n
1372                    if (i==k) go to 1060
1373                    ik=i+n*(k-1)
1374                    a(ik)=a(ik)/(-a(kk))
1375    1060       continue
1376   c
1377   c  Reduce matrix
1378   c
1379               do 1070 i=1,n
1380                    do 1070 j=1,n
1381                    if (i==k.or.j==k) go to 1070
1382                    ij=i+n*(j-1)
1383                    ik=i+n*(k-1)
1384                    kj=k+n*(j-1)
1385                    a(ij)=a(ik)*a(kj)+a(ij)
1386    1070       continue
1387   c
1388   c  Divide row by pivot
1389   c
1390               do 1080 j=1,n
1391                    if (j==k) go to 1080
1392                    kj=k+n*(j-1)
1393                    a(kj)=a(kj)/a(kk)
1394    1080       continue
```

```
1395  c
1396  c  Continued product of pivots
1397  c
1398              d=d*a(kk)
1399              a(kk)=1.0d0/a(kk)
1400   1090 continue
```

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SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1401  c
1402  c  Final row and column interchange
1403  c
1404   1100 k=ksave+1
1405   1110 k=k-1
1406        if (k<=0) go to 1150
1407  c
1408  c  Restore columns.
1409  c
1410        i=l(k)
1411        if (i<=k) go to 1130
1412        do j=1,n
1413             jk=j+n*(k-1)
1414             ji=j+n*(i-1)
1415             tem=a(jk)
1416             a(jk)=-a(ji)
1417             a(ji)=tem
1418        enddo
1419  c
1420  c  Restore rows.
1421  c
1422   1130 j=m(k)
1423        if (j<=k) go to 1110
1424        do i=1,n
1425             ki=k+n*(i-1)
1426             ji=j+n*(i-1)
1427             tem=a(ki)
1428             a(ki)=-a(ji)
1429             a(ji)=tem
1430        enddo
1431        go to 1110
1432  c
1433  c  Set the rank of the matrix and return to the calling routine.
1434  c
1435   1150 return
1436        end
```

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SUBROUTINE NEWPAG Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1437  c-------------------------------------------------------------------------
1438        SUBROUTINE NEWPAG
1439  c
1440        common /titlep/ title, page, out, img, dig
1441        character*74 title
1442        integer page, out, img, dig
1443  c
1444        page=page+1
```

```
1445        if(page>1)write(out,*) char(12)
1446        write (out,10) page,title
1447   10   format(' Naval BioDynamics Laboratory   PREP',31x,'    Page',i3
1448       .            /a74/)
1449        end
```

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SUBROUTINE CLEAR Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1450  c-------------------------------------------------------------------------
1451        SUBROUTINE CLEAR
1452  c  clears the screen and moves the cursor to row 8.
1453        write (*,*) char(27)//'[2J'
1454        write (*,*) char(27)//'[1;1H'
1455        write (*,*) char(27)//'[8B'
1456        end
```

Customized GIANT Program Listings

Main Program

```
F77L - Lahey FORTRAN 77, Version 5.01    07 Apr 93 08:59:19                    Page    1
PROGRAM NBDL_GIANT     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

        1        PROGRAM NBDL_GIANT
        2  C
        3  C  GENERAL INTEGRATED ANALYTICAL TRIANGULATION (GIANT)
        4  C
        5        common /titlep/ jtitle, ipage
        6        character jtitle*76
        7        include 'inc\tapes.inc'
I1      1        INTEGER CAMERA,FRAMES,OBJECT
I1      2        COMMON /TAPES/  IN,IO,IOS,IOIC,   IP1,   IP2,
I1      3       .                CAMERA,IMAGES,FRAMES,OBJECT,
I1      4       .                ITAPE1,ITAPE2,ITAPE3,ITAPE4,
I1      5       .                ITAPE5,ITAPE6,ITAPE7,ITAPE0
I1      6
        8        common /offset/off(2)
        9        common /anthr/ians, p(15, 3)
       10        real*8 p
       11  C
       12        character irun*6, fn*12
       13        call system('cls')
       14        IN=11
       15        IO=12
       16        IOS=13
       17        IP1=14
       18        IP2=15
       19        CAMERA=IN
       20        IMAGES=16
       21        FRAMES=IN
       22        OBJECT=IN
       23        ITAPE1=17
       24        ITAPE2=18
       25        ITAPE3=19
       26        ITAPE4=20
       27        ITAPE5=21
       28        ITAPE6=22
       29        ITAPE7=23
       30        ITAPE0=24
       31        IOIC=25
       32  C
       33        write(*,*)' Enter 0 for initial conditions'
       34        write(*,*)' Enter 1 for head anthropometry'
       35        write(*,*)' Enter 2 for body anthropometry'
       36        write(*,*)' Enter 3 for standard giant     '
       37        read(*,*)ians
       38        if (ians==0) then
       39          open (in, status='old', file='optcams.dat')
       40        elseif (ians==1) then
       41          open (in, status='old', file='opthead.dat')
       42        elseif (ians==2) then
       43          open (in, status='old', file='optxray.dat')
```

```
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PROGRAM NBDL_GIANT     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

       44        else
       45           open (in, status='old', file='opt.dat')
       46        endif
       47        if(ians==0)then
       48  1        write(*,*)' Enter RUN number (A6):  '
       49           read  (*,*) irun
       50           do i=1,6
       51              if(irun(i:i)==' ')go to 1
       52           enddo
       53           write (*,*)
       54           jtitle='   35mm Still Camera System for Initial Conditions of
       55      .    RUN # = '//irun
       56           open (images, status='old', file=irun//'im.dat')
       57           open (unit=io, status='unknown',file=irun//'.132')
       58           open (unit=io, status='unknown',file='nul')
       59           open (unit=ios,status='unknown',file=irun//'.out')
       60           open (unit=ioic,status='unknown',file=irun//'.ic')
       61        elseif(ians<3)then
       62           write (*,*) ' Enter HRV number: '
       63           read  (*,*) ihrv
       64           write (*,*)
       65           if(ians==1)then
       66              write (fn,"(i4.4,'himg.dat')")ihrv
       67             jtitle='   35mm Still Camera System for Head Anthropometry of
       68      .       HRV # = '//fn(1:4)
       69              open (unit=ios,status='unknown',file=fn(1:4)//'head.out')
       70              open (images,status='old',file =fn)
       71              read (images, *) off
       72              if (dabs(off(1)+off(2)-10)>2) then
       73                 write(*,*) 'Offset sum < 8 or > 12. check it out.'
       74                 stop
       75              endif
       76           else
       77              write (fn,"(i4.4,'bimg.dat')")ihrv
       78              jtitle='       X-Ray Determination of Body Anthropometry of
       79      .       HRV # = '//fn(1:4)
       80              open (unit=ios,status='unknown',file=fn(1:4)//'body.out')
       81              open (images,status='old',file =fn)
       82           endif
       83           open (unit=io, status='unknown',file=fn(1:5)//'.132')
       84        else
       85           write(*,*)' Enter title (A76) '
       86           write(*,*)
       87           read(*,'(A)')jtitle
       88           open (images,status='old',file ='img.dat')
       89           open (unit=io, status='unknown',file='giant.132')
       90           open (unit=ios,status='unknown',file='giant.out')
       91        endif
       92  C
       93        DO 1010 I=ITAPE1,ITAPE6


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PROGRAM NBDL_GIANT     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

       94   1010 OPEN (UNIT=I,STATUS='SCRATCH',FORM='UNFORMATTED')
       95  C
       96  C  Initialize job title, page count, and data set identifications
```

```
 97  C
 98        I    Page=0
 99        CALL CLR
100        write(*,*) char(7)
101  C
102  C  Perform data input and structuring phase, then close input files.
103  C
104        CALL CLR
105        CALL PHASE1
106        CLOSE (IN)
107        CLOSE (IMAGES)
108  C
109  C  Perform triangulation phase
110  C
111        OPEN (UNIT=ITAPE0,STATUS='UNKNOWN')
112        OPEN (UNIT=ITAPE7,STATUS='SCRATCH',FORM='UNFORMATTED')
113  C
114        CALL CLR
115        WRITE (*,'(37X,''PHASE 2'')')
116        CALL PHASE2
117  C
118  C  Perform data output phase
119  C
120        CLOSE (ITAPE0)
121        CLOSE (ITAPE1)
122        CALL CLR
123        WRITE (*,'(37X,''PHASE 3'')')
124        CALL PHASE3
125        write(*,*) char(7)
126        CALL CLR
127        write(*,*) char(7)
128        if(ians==0)then
129           WRITE (*,"(/////,26X,'Results are in ',a6,'.out.')")irun
130           WRITE (*,"(/////,16X,'Initial Conditions Results are in ',a6,
131       .         '.ic.')")irun
132        elseif(ians==1)then
133           WRITE (*,"(/////,26X,'Results are in ',a4,'head.out.')")fn(1:4)
134        elseif(ians==2)then
135           WRITE (*,"(/////,26X,'Results are in ',a4,'body.out.')")fn(1:4)
136        else
137           WRITE (*,"(/////,26X,'Results are in giant.out.')")
138        endif
139        END
```

Subroutines

```
F77L - Lahey FORTRAN 77, Version 5.01    07 Apr 93 08:59:19                                    Page  139
SUBROUTINE STUFFP     Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing
```

```
4426  C*****
4427        SUBROUTINE STUFFP(ID2, OBJECT)
4428  C  Search object point ids to find matching ids in anthropometry list
4429  C
4430        REAL*8 P, OBJECT(3)
4431  C     CHARACTER*4 ID(15)
4432        COMMON /TAPES/  IN,IO,IOS,IDUM(15)
4433        COMMON /ANTHR/IANTH, P(15, 3)
4434        DIMENSION  ID(15)
4435        DATA ID/'r1-l','r2-l','r3-l','r4-l',
4436       .        'r1-r','r2-r','r3-r','r4-r', ' lon',' ron',
4437       .        'igin','b_Lf', 'b_Rt','eTop', 'eBot' /   ! 15
4438        DO I=1, 15
```

```
4439           IF (ID2.EQ.ID(I))THEN
4440  C
4441  C  Stuff object points into corresponding locations in array P
4442  C
4443              DO J=1, 3
4444                 P(I, J)=OBJECT(J)
4445              enddo
4446              RETURN
4447           ENDIF
4448        enddo
4449        END
```

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SUBROUTINE ANTHRO Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4450  C*****
4451        SUBROUTINE ANTHRO
4452  C  Verify that we have the 18/13 needed anthro points,
4453  C  call the routine to find the transformations & print results
4454  C
4455        REAL*8 P, X(3),  AB(3, 3)
4456        COMMON /TAPES/  IN,IO,IOS,IDUM(15)
4457        COMMON /ANTHR/IANTH, P(15, 3)
4458        CHARACTER*4 TYPE(2)/'HEAD', 'BODY'/
4459  C
4460        CALL NEWPAG
4461        WRITE(IO, '(44XA40//)')'A N T H R O P O M E T R Y    O U T P U T'
4462        WRITE(IOS,'(20XA40//)')'A N T H R O P O M E T R Y    O U T P U T'
4463        I1=1
4464        I2=10
4465        IF(IANTH.EQ.2)THEN
4466           I1=11
4467           I2=15
4468        ENDIF
4469        DO 10 I=I1, I2
4470        IF(P(I,3).EQ.0.)THEN
4471           WRITE(IO, *)' Can''t find 10 head or  5 body points--halting'
4472           WRITE(IOS,*)' Can''t find 10 head or  5 body points--halting'
4473           RETURN
4474        ENDIF
4475   10   CONTINUE
4476  c     ************************************************
4477        CALL NBDL (X, AB)
4478        WRITE(IO, 8) TYPE(IANTH), X, TYPE(IANTH), AB
4479        WRITE(IOS, 9)TYPE(IANTH), X, TYPE(IANTH), AB
4480    8   FORMAT(38X'T-PLATE ORIGIN WITH RESPECT TO ',A4,
4481       . ' ANATOMICAL ORIGIN'
4482       . //41X'X= '2PF8.4,'cm    Y= 'F8.4,'cm    Z= 'F8.4,'cm'0P///
4483       .  35X'T-PLATE ORIENTATION WITH RESPECT TO ',A4,
4484       . ' ANATOMICAL SYSTEM' //3(47X,3F11.6/))
4485    9   FORMAT(14X'T-PLATE ORIGIN WITH RESPECT TO ',A4,
4486       . ' ANATOMICAL ORIGIN'
4487       . //17X'X= '2PF8.4,'cm    Y= 'F8.4,'cm    Z= 'F8.4,'cm'0P///
4488       . 11X'T-PLATE ORIENTATION WITH RESPECT TO ',A4,
4489       . ' ANATOMICAL SYSTEM' //3(23X,3F11.6/))
4490        END
```

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SUBROUTINE UVEC Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4491  C*****
4492        SUBROUTINE UVEC (A,K)
4493  C  Make a unit vector: A(K,-) = A(K,-) / MAGNITUDE (A(K, -))
4494  C
4495        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
4496        DIMENSION A(3, 3)
4497  C
4498        B=0
4499        DO 10 I=1, 3
4500   10   B=B+A(K, I)**2
4501        B=DSQRT(B)
4502        DO 20 I=1, 3
4503   20   A(K, I)=A(K, I)/B
4504        END
```

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SUBROUTINE NBDL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4505  C*****
4506        SUBROUTINE NBDL (X, AB)
4507  C  Find the origin & transformation matrix of the T-plate relative to the
4508  C  head (body) anatomical origin in the head (body) anatomical coord system
4509  C
4510        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
4511        COMMON /ANTHR/IANTH, P(15, 3)
4512        DIMENSION  X(3),  AB(3, 3),  A(3, 3), B(3, 3), Q(3)
4513  C
4514        C=0.D0
4515        D=0.D0
4516        IF(IANTH.EQ.1)THEN
4517           call extrapolate    ! 1-4-->4  &  5-8-->8
4518           DO 10 I=1, 3
4519  C  Find origin of Head Anatomical Coordinate System
4520              X(I)=(P(4,I)+P(8,I))/2
4521  C  Find x-axis
4522              A(1,I)=(P(9,I)+P(10,I))/2-X(I)
4523  C  Find origin of T-plate
4524              Q(I)=0
4525  C  Find x-axis of T-plate
4526              B(1,I)=0
4527              if(i==1)B(1,I)=1
4528  C  Find approx. y-axes
4529              A(2,I)=P(4,I)-X(I)
4530              B(2,I)=0
4531              if(i==2)B(2,I)=1
4532  C  Interchange ltp and rtp when processing a-plate (180 rot re z)
4533  C           B(2,I)=P(12,I)-P(11,I)      !rhesus  right-left   xxxxx
4534  C  Find vector from head anat to T-plate
4535   10      Q(I)=Q(I)-X(I)
4536        ELSE
4537           DO 11 I=1, 3
4538  C  Find origin of Body Anatomical Coordinate System
4539              X(I)=P(11,I)
4540  C  Find x-axis
4541              A(1,I)=X(I)-(P(14,I)+P(15,I))/2
4542  C  Find origin of T-plate
4543              Q(I)=0
```

```
4544  C  Find x-axis of T-plate
4545               B(1,I)=0
4546               if(i==1)B(1,I)=1
4547  C  Find approx. y-axes
4548               A(2,I)=P(12,I)-P(13,I)
4549               B(2,I)=0
4550               if(i==2)B(2,I)=1
4551  C  Find vector from body anat to T-plate
4552   11       Q(I)=Q(I)-X(I)
4553         ENDIF
```


SUBROUTINE NBDL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4554  C  Make unit vectors of x-axes
4555         CALL UVEC(A, 1)
4556         CALL UVEC(B, 1)
4557  C  Find components of the approx y-axes along the respective x-axes
4558         DO 20 I=1, 3
4559         C=C+A(1,I)*A(2,I)
4560   20    D=D+B(1,I)*B(2,I)
4561  C  Subtract these to yield y-axes perpendicular to the resp x-axes
4562         DO 30 I=1, 3
4563         A(2,I)=A(2,I)-C*A(1,I)
4564   30    B(2,I)=B(2,I)-D*B(1,I)
4565  C  Make them of unit length
4566         CALL UVEC(A, 2)
4567         CALL UVEC(B, 2)
4568  C  Find the z-axes by taking the cross products of the x-axes & y-axes
4569         DO 40 I=1, 3
4570         J=I+1
4571         IF(J.GT.3)J=J-3
4572         K=I+2
4573         IF(K.GT.3)K=K-3
4574         A(3,I)=A(1,J)*A(2,K)-A(1,K)*A(2,J)
4575   40    B(3,I)=B(1,J)*B(2,K)-B(1,K)*B(2,J)
4576  C  Find the components of the transformation vector and matrix in
4577  C  the head (body) anatomical coordinate system
4578         DO 50 I=1, 3
4579         X(I)=0.D0
4580         DO 50 J=1, 3
4581         X(I)=X(I)+Q(J)*A(I,J)
4582         AB(J,I)=0.D0
4583         DO 50 K=1, 3
4584   50    AB(J,I)=AB(J,I)+B(I,K)*A(J,K)
4585         END
```


SUBROUTINE EXTRAPOLATE Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4586  c
4587         SUBROUTINE EXTRAPOLATE
4588         common /offset/off(2)
4589         COMMON /ANTHR/IANTH, P(15, 3)
4590         real*8 p, x(4),y(4),z(4),t(4)
4591         n=4
4592         do k=1, 2
4593            t1=0.d0
```

```
4594            t2=0.d0
4595            x1=0.d0
4596            xt=0.d0
4597            y1=0.d0
4598            yt=0.d0
4599            z1=0.d0
4600            zt=0.d0
4601            do i=1,n
4602               j=i+4*(k-1)
4603               t(i)=(i-1)*25.4d0                ! 0, 1, 2, 3 in inches
4604               t1=t1+t(i)
4605               t2=t2+t(i)*t(i)
4606               x(i)=p(j,1)
4607               x1=x1+x(i)
4608               xt=xt+t(i)*x(i)
4609               y(i)=p(j,2)
4610               y1=y1+y(i)
4611               yt=yt+t(i)*y(i)
4612               z(i)=p(j,3)
4613               z1=z1+z(i)
4614               zt=zt+t(i)*z(i)
4615            enddo
4616            den=n*t2-t1*t1
4617            ax= ( n*xt-x1*t1)/den
4618            bx=-(t1*xt-x1*t2)/den
4619            ay= ( n*yt-y1*t1)/den
4620            by=-(t1*yt-y1*t2)/den
4621            az= ( n*zt-z1*t1)/den
4622            bz=-(t1*zt-z1*t2)/den
4623            p(4*k,1)=ax*off(k)*25.4d0+bx
4624            p(4*k,2)=ay*off(k)*25.4d0+by
4625            p(4*k,3)=az*off(k)*25.4d0+bz
4626
4627         enddo
4628         end
```

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SUBROUTINE GETICV Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4629  C*****
4630        SUBROUTINE GETICV(ID2,OBJECT,GPCOV)
4631  C
4632  C  Search object point ids to find matching ids of targets on the head,
4633  C  mouth and neck. Desired variables are saved.
4634  C
4635        REAL*8          OBJECT(3),GPCOV(3,3),VARH,VARM,VARN,VAR2
4636        CHARACTER*4     VAR
4637  C
4638        COMMON /TAPES/  IN,IO,IOS,IOIC,IDUM(14)
4639        COMMON /CONS/   NH,NM,NN,VARH(24,13),VARM(24,13),VARN(24,13)
4640  C
4641        DIMENSION       IDH(24),IDM(24),IDN(24)
4642  C
4643        DATA IDH /'hrc1','hrc2','hrc3','hrc4',
4644       .          'hrc5','hrc6','hrc7','hrc8',
4645       .          'hcc1','hcc2','hcc3','hcc4',
4646       .          'hcc5','hcc6','hcc7','hcc8',
4647       .          'hlc1','hlc2','hlc3','hlc4',
4648       .          'hlc5','hlc6','hlc7','hlc8'/
4649        DATA IDM /'mrc1','mrc2','mrc3','mrc4',
4650       .          'mrc5','mrc6','mrc7','mrc8',
4651       .          'mcc1','mcc2','mcc3','mcc4',
```

```
4652       .          'mcc5','mcc6','mcc7','mcc8',
4653       .          'mlc1','mlc2','mlc3','mlc4',
4654       .          'mlc5','mlc6','mlc7','mlc8'/
4655        DATA IDN /'nrc1','nrc2','nrc3','nrc4',
4656       .          'nrc5','nrc6','nrc7','nrc8',
4657       .          'ncc1','ncc2','ncc3','ncc4',
4658       .          'ncc5','ncc6','ncc7','ncc8',
4659       .          'nlc1','nlc2','nlc3','nlc4',
4660       .          'nlc5','nlc6','nlc7','nlc8'/
4661  C
4662        EQUIVALENCE (VAR,VAR2)
4663  C
4664        DO 40 I=1,24
4665  C
4666  C  SAVE MOUTH DATA
4667  C
4668        IF(ID2.EQ.IDM(I)) THEN
4669  C
4670  C  ENCODE CHARACTER DATA
4671          WRITE(VAR,50) ID2
4672  C
4673        NM=NM+1
4674          VARM(I,1)=VAR2
4675                VARM(I,2)=OBJECT(1)
4676          VARM(I,3)=OBJECT(2)
4677          VARM(I,4)=OBJECT(3)
```

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SUBROUTINE GETICV Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4678          K=4
4679          DO 10 J=1,3
4680          DO 10 J1=1,3
4681          K=K+1
4682    10    VARM(I,K)=GPCOV(J,J1)
4683  C
4684  C  SAVE HEAD DATA
4685  C
4686        ELSE IF(ID2.EQ.IDH(I)) THEN
4687        WRITE(VAR,50) ID2
4688          NH=NH+1
4689          VARH(I,1)=VAR2
4690                VARH(I,2)=OBJECT(1)
4691          VARH(I,3)=OBJECT(2)
4692          VARH(I,4)=OBJECT(3)
4693          K=4
4694          DO 20 J=1,3
4695          DO 20 J1=1,3
4696          K=K+1
4697    20    VARH(I,K)=GPCOV(J,J1)
4698  C
4699  C  SAVE NECK DATA
4700  C
4701        ELSE IF(ID2.EQ.IDN(I)) THEN
4702        WRITE(VAR,50) ID2
4703          NN=NN+1
4704          VARN(I,1)=VAR2
4705                VARN(I,2)=OBJECT(1)
4706          VARN(I,3)=OBJECT(2)
4707          VARN(I,4)=OBJECT(3)
4708          K=4
4709          DO 30 J=1,3
```

```
4710          DO 30 J1=1,3
4711          K=K+1
4712    30    VARN(I,K)=GPCOV(J,J1)
4713        ENDIF
4714  C
4715    40  CONTINUE
4716  C
4717    50  FORMAT(A4)
4718        RETURN
4719        END
```

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SUBROUTINE ICONS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4720  C*****
4721        SUBROUTINE ICONS
4722  C
4723  C  Write Initial Conditions data to a file.
4724  C
4725        REAL*8 VARH,VARM,VARN
4726  C
4727        COMMON /TAPES/  IN,IO,IOS,IOIC,IDUM(14)
4728        COMMON /CONS/ NH,NM,NN,VARH(24,13),VARM(24,13),VARN(24,13)
4729  C
4730        CHARACTER*4 TYPE(3)/'MOUT', 'HEAD', 'NECK'/
4731  C
4732  C   WRITE MOUTH DATA
4733  C
4734        IF(NM.EQ.0) GO TO 20
4735        WRITE(IOIC,100) TYPE(1)
4736        DO 10 I=1,24
4737        IF(VARM(I,1) .EQ. 0) GO TO 10
4738        WRITE(IOIC,100) VARM(I,1)
4739        J1=2
4740        J2=4
4741        DO 5 I1=1,4
4742        WRITE(IOIC,200) (VARM(I,J),J=J1,J2)
4743        J1=J2+1
4744        J2=J2+3
4745     5  CONTINUE
4746    10  CONTINUE
4747        WRITE(IOIC,300)
4748  C
4749  C  WRITE HEAD DATA
4750  C
4751    20  IF(NH.EQ.0) GO TO 40
4752        WRITE(IOIC,100) TYPE(2)
4753        DO 30 I=1,24
4754        IF(VARH(I,1) .EQ. 0) GO TO 30
4755        WRITE(IOIC,100) VARH(I,1)
4756        J1=2
4757        J2=4
4758        DO 25 I1=1,4
4759        WRITE(IOIC,200) (VARH(I,J),J=J1,J2)
4760        J1=J2+1
4761        J2=J2+3
4762    25  CONTINUE
4763    30  CONTINUE
4764        WRITE(IOIC,300)
4765  C
4766  C  WRITE NECK DATA
4767  C
```

```
4768    40  IF(NN.EQ.0) GO TO 60
```

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SUBROUTINE ICONS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4769        WRITE(IOIC,100) TYPE(3)
4770        DO 50 I=1,24
4771        IF(VARN(I,1) .EQ. 0) GO TO 50
4772        WRITE(IOIC,100) VARN(I,1)
4773        J1=2
4774        J2=4
4775        DO 45 I1=1,4
4776        WRITE(IOIC,200) (VARN(I,J),J=J1,J2)
4777        J1=J2+1
4778        J2=J2+3
4779    45  CONTINUE
4780    50  CONTINUE
4781    60  WRITE(IOIC,300)
4782        WRITE(IOIC,300)
4783  C
4784  C     RESET VARIABLE COUNTERS
4785  C
4786        NH=0
4787        NM=0
4788        NN=0
4789  C
4790   100  FORMAT(A4)
4791   200  FORMAT(3(D11.4,1X))
4792   300  FORMAT('EOFEOF')
4793  C
4794         END
```

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